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DEPARTMENT OF AGRICULTURE

OF

WESTERN AUSTRALIA

ISSUED BY DIRECTION OF

THE HONOURABLE THE MINISTER FOR LANDS.

EDITED BY

G. CHITTY BAKER.

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JOURNAL

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Vol. IX. JANUARY, 1904. Part 1.

NOTES.

Rabbit Proof Netting.—The Hon. the Minister for Lands has been pleased to approve of the supplying of wire-netting for fencing to any settler in any part of the State.

Stud. Bull.—The Government shorthorn stud bull "Pride of Argyle" is at present disengaged. Applications for the loan of same will be received by the Director of Agriculture.

Tobacco Growing.—The tobacco crop in the United States last year represented 821,823,963lbs., grown upon 1,030,734 acres of land. The value in its raw state was set down at £11,742,956.

Rabbit Poisoning.—Considerable success has been made at Ivanhoe, Trangie, N.S.W., in the destruction of rabbits by poisoning water by means of arsenic. As many as 3,000 rabbits a week have been destroyed by this method.

Search for Parasites.—Mr. G. Compere, the Government Entomologist, has left the State *en route* for Brazil, where he is in hopes of being able to obtain the parasite to the fruit fly that is at present so destructive amongst us.

Pampas Grass.—It is surprising that none of our settlers have ever gone in for growing Pampas Grass for its plumes. Last year 1,000,000 were grown in Northern California for export purposes. These fetch about £40 per 1,000 plumes.

Dairy Schools.—There are two dairy schools in Sweden run by the Government (Alnarp and Ultuna) giving dairy and agricultural education. The pupils go for one or two years, the first year for practical work, and the second year for laboratory and chemical work.

Wheat Yield.—With the opening up of the Canadian north-west territories there has been a steady and marked increase in the amount of land under cereal crop. The wheat area has increased from 307,000 acres in 1898 to 626,000 acres last year. In regard to oats, the increase has been greater, from 105,000 acres in 1898 to 310,000 acres last year, an increase of almost 300 per cent. during five years.

Incubators.—In response to a request made in the last issue of the *Journal*, inviting the experience of those using incubators, we have to acknowledge the receipt of several letters. In order to obtain as much information as possible, we again ask those who may have used incubators and have not already sent their experience in, to do so as early as possible, giving the name of the machine, whether it is hot water or air, and any other particulars that may be of interest.

Food for Pigs.—The best, cheapest, and most economical food to use with boiled potatoes for the fattening of bacon pigs is a mixture of one of wheat, one of barley, and one-half of white peas. The latter improves the quality of the bacon immensely, rendering it less likely to waste in the pot by boiling out. Mix the grain and have them ground finely. Feed at a temperature of not less than 60 deg.; keep the styes clean, and avoid all underground drains. Douche the yards daily with cold water and sweep out with a hard brush.

Prospects for Australian Apples in London.—Mr. T. B. Walker, Australian representative of Messrs. Edward Jacobs & Sons, fruitbrokers, of Covent Garden, forwards us the following information, received this week:—"'Owing to the scarcity of apples in England, the Americans, Nova Scotians, and Canadians are having a very good time at the sales; and we have every hope that the Australian apples will meet a good market. My firm add that the

late Californian apples are the only ones that could possibly interfere with those from Australia; but they have never done so to any appreciable extent in the past, and I do not think it is very probable that they will do so in this instance."

RED WATER IN LAMBS.—Under the term red water, several diseases are included: indeed, red water (*sanguineous ascites*) is a result of disease rather than a disease itself. It frequently happens that whenever a shepherd on opening a sheep's carcase finds an accumulation of water in the abdomen he at once sets this down as the cause of death, and overlooks the disease which has produced the water. Probably the water in some lambs is caused by derangement of the liver, and the following should be a good medicine with which to drench them once or twice a week:—Sulphate of magnesia, 4oz.; extract of taraxacum, 1oz.; carbonate of iron, 2 drachms; water, $1\frac{1}{2}$ pints. Dissolve the magnesia and the taraxacum in water, and then add the iron. This is one dose each for six lambs. Avoid all watery and innutritious foods.

RABBIT EXTERMINATION.—Recently a number of gentlemen—scientific, pastoral, and commercial—assembled by invitation at Dr. O'Hara's private residence, "Mandalay," St. Kilda Road, Melbourne, to witness an experiment in rabbit extermination. For the purpose of demonstrating the capabilities of "the destroyer," a score of rabbits were let loose on the lawn. The machine, which is the invention of Messrs. Parker Bros., is a combination of ingenuity and simplicity. The managing director of the syndicate, Mr. G. V. S. Dunn, prior to the trial, thoroughly explained the objects, manufacture, and working of the machine. Briefly, the *modus operandi* is as follows:—A small cylinder holding a quart of "extermination" (1,350 shots) is placed in and on a level with the ground. When charged, an ordinary bicycle pump is used to obtain the air pressure necessary in the cylinder. At one end is a small zinc platform, and on the other a minute ejector. When the rabbit passes over the platform, a lever in conjunction with the ejector discharges a small quantity of fluid over the rabbit's fur. This, cat like, they attempt to remove with their mouth, the result being that in a few hours the animal is released from all further troubles. The score experimented on, with one exception, all succumbed during the evening. Dr. O'Hara is the discoverer of the pleasant, but effective, poison utilised in the patentees' machine.

VINTAGE NOTES.

By A. Despeissis.

When these notes appear, vineyard proprietors will be actively engaged preparing to transfer the produce of their vines to the fermenting sheds and the cellars.

At such time attention to a few facts calculated to insure a healthy fermentation and the manufacture of wholesome wine, possessed of good keeping qualities, will result in a readily saleable article when age has had time to effect the necessary refining influence on the fermented juice of the grapes.

Three types of wines are made in our cellars: 1° red dry wine, 2° white dry wine, and 3° sweet wines, both red and white.

Before considering either of these classes of wine, however, it is necessary not to overlook the preliminary preparation which the wine-making appliances have to undergo.

These need not necessarily be housed in costly and specially constructed cellars, and the chief requisites are plenty of air, fresh and cool, and not vitiated by smells such as are generated by stagnant pools of water, stables, or other smell foreign to the wine. For that purpose even an open bough-shed answers the purpose, and is certainly preferable to the confined, warm atmosphere of a badly ventilated building.

The necessity of having all casks and wine-making appliances clean and sweet and free from the least taint of mould is so evident that it need only be mentioned.

In order to effect the thorough cleansing and disinfection of casks, reference is invited to the pages of the "Handbook of Horticulture and Viticulture of Western Australia," in which some efficacious processes are reviewed.

Any taint whatsoever in the wine is objectionable, and deteriorates the value of the article.

A simple enumeration of the cause of these taints will often enable one to guard against their appearance, viz.:—

Taints caused by diseased grapes.

Taints caused during the pressing and fermentation of the juice, mostly by additions of foreign substances.

Taints caused by the wooden vessels used.

Red Wines.

By such I have in my mind wines that have completely fermented and in which no appreciable amount of sugar remains. Such wines are called "dry" in the trade.

As the grapes ripen no time should be lost in gathering them.

More juice is thus present in the berries, and consequently a better return is obtained per ton of grapes crushed. That juice has its several component parts better balanced, sugar and natural acids are present in the liquid in such proportions as will insure a thorough fermentation, resulting in a wine fresh to the palate and capable of developing on maturing those qualities which make the wine pleasant and wholesome to drink.

Either owing to lack of facilities and appliances for dealing quickly with vintage, or through an error of judgment in assuming that the ripest grapes yield the best wine, the must too often reaches the fermenting vat in our cellars so rich in sugar and so poor in those natural acids inherent to the juice of the grape, that fermentation is fitful, and is accompanied by so considerable generation of heat that the wine often becomes diseased.

The best light wines result from must weighing 10° to 12° Baumé, and containing 18 to 21 per cent. of sugar. From 12·5° to 14·5° Baumé, or 23 to 26 per cent. of sugar, the resulting wine is of a heavy character, whilst above that strength, viz., 15·5° to 17·5° Baumé, or 28 to 32 per cent. of sugar, fermentation is incomplete, and the wine remains more or less sweet, according to the amount of sugar left in it.

The process by means of which grape sugar is converted into spirit is that of vinous fermentation, and that process is effected by live workers, which are known as ferments, yeasts, or levures.

These levures are carried on the grapes themselves, not as we see them when a drop of fermenting wine is examined under the microscope, as strings of beads, but under a form which is to the yeast itself what the seed is to the plant.

By fostering the germination and the growth of those seeds or spores, under conditions to their liking, we breed the yeast germ which effects the gradual change of grape-sugar into wine.

The two chief conditions which favour the growth of these spores and the resulting yeast are air and warmth. Excess of warmth, however, is fatal to their growth, and every man who makes wine should know what degree of heat is fatal to the yeast germs and how to regulate the temperature best suited to their growth.

Grape Crushing.

The first operation which takes place in the cellar when the grapes are brought in, is that of crushing of the grapes. The object of such an operation is to tear the skin, liberate the juice,

aerate it and sow that mass of crushed grapes with the seeds of germs which will bring about fermentation.

That operation was for a long time done by treading the grapes on a shallow platform; nowadays it is effected with the aid of mechanical appliances. This latter method recommends itself both on the score of economy and that of efficiency. In order that the results be as satisfactory as was the case when the old method of treading by foot was generally practised, it is necessary to so manipulate the grapes that they are subjected to influences similar to those which obtain when treading takes place.

The process must favour a thorough aeration of the crushed grapes, as air is essential to the life and growth of the yeast. For that purpose the machine known as stemmer and crusher, answers admirably. It churns up the broken grapes, tears off the stalks from the berries and ejects them at one of the ends of the machine. The question as to whether it is advisable to separate the stalks from the berries before fermentation, has been answered in the affirmative as regards Australia. With grapes such as ours, so rich in sugar and in extractive matters, it smooths the wine and reduces the harshness.

Before vatting the crushed grapes the pulpy mass should be left exposed to the air sufficiently long to insure the absorption of air.

Vatting.

The crushed berries are next transferred to the fermenting vats. Open vats are preferred in Australia and where no attemporators or refrigerators are used. If these be large, it is advisable to provide them with a grating as a false head, which is fitted on the top of the charge of grapes in order to obviate the necessity of poking the floating cap down two or three times a day. At this stage any correction that is deemed necessary to effect to bring the grape must to the required standard should be attended to. At the beginning of vintage the juice will be acid enough, and if chemically tested will be found to contain about 8 per mille of acids expressed as tartaric acid. That amount of natural acidity will, by combining with other constituents of the wine, impart a fresh taste to the wine, and will also tend to add brilliancy to the colour and pleasantness of the bouquet.

Lack of acidity, on the other hand, often results in a wine of a dull, leaden colour, and of a heavy, flat taste.

A moderately acid liquid, moreover, is one in which the pure wine yeast thrives, whilst on the other hand it is unfavourable to dangerous microbes which produce sickness in the wine.

Towards the end of the vintage, therefore, when the acidity of the must decreases whilst its sweetness increases, it is advisable to strengthen that acidity and to bring it up to the standard of 8 per mille. For that purpose every 1 per mille may be calculated as 1lb. of tartaric acid crystals per 1,000lbs., or in other words, for

every 100 gallons of juice. Thus a shiraz or a malbec juice showing 6 per mille of acidity, calculated as tartaric acid, can easily be brought up to 7 or 8 per mille by the addition of 1lb. or 2lbs. of crystals of that acid for every 100 gallons.

This tartaric acid only temporarily, however, adds to the acidity of the must, and helps it fermenting without accidents; by degrees, it combines with the potash in the wine, and precipitates as cream of tartar, which either settles on the side of the cask or is removed with the lees when the wine is racked.

The next step consists in adding to the crushed grapes what in dairies is called a "starter:" that is to say, in adding to the crushed mass a bucketful or two of must already in full fermentation, which will cause the vat to soon show signs of life.

As fermentation proceeds, carbonic acid gas bubbles through the mass and bursts on the surface, and all the while is generated. In localities such as those extending northward of Bunbury, where the temperature is rather warm at vintage time, that heat may rise too high, and it is imperative to either check it or lower it by some means or other.

On small vineyards, the grapes picked in the afternoon may be exposed to the cool night air, and then crushed in the morning, but that method is impracticable and cumbersome where the vintage is of any importance.

A method employed all over Algeria is to run the heated fermenting must through a refrigerator, such as is used in dairies. The apparatus, however, is rather costly.

Where a supply of ice at a reasonable price is easily procurable, the simplest way is to fill tins with that ice, and weight it partly down into the must, which may be drawn at the bottom, and pumped back again to equalise the temperature in the fermenting mass.

It is reckoned that a little over 5lbs. of ice will lower the temperature of 100 gallons 1° F.

Of the various kinds of yeast which effect wine fermentation, two, known as *Saccharomyces pastorianus* and *S. apiculatus*, work best when the temperature is below 75° F., and then become enfeebled as the heat increases. These two sorts, however, cannot compare, as regards the work they do, with another kind, and the best of all the wine yeasts, viz., the "elliptic" yeast, which works best at temperatures ranging between 80° and 90° F., and finds its energies crippled when the temperature rises above 95° F.

At higher temperatures injurious microbes invade the fermenting wine, and it is therefore essential that the must in the vats be kept within the limits mentioned.

In Australia, and with the grapes which predominate in our vineyards, the wine is, if anything, too dense in colour for the requirements of the market, and it will therefore in many cases be

found advisable to draw off the wine 3 or 4 days or so after crushing. Where on the other hand the red wine is deficient in colour it should be left on the skins until it has completely fermented, which will be in 5 to 6 days, provided the temperature during that time has been maintained between 80° and 90° F. It may happen that although the bubbling has ceased inside the vat, and to all appearances the wine has completed its fermentation, it still tastes sweet to the mouth, and shows, when tested with the spindle saccharometer, that there is still some unfermented sugar left in it.

This accident in grape juice not too rich in sugar is caused either by lack of air or by excess of heat. The remedy is therefore easy to apply, but it is also advisable to resow the partly fermented mass with some young healthy yeast from another vat in full fermentation.

Drawing off.

Three to four days, and in exceptional circumstances, six days on the skins are as long as the grape juice needs, to produce a nice red wine.

The operation of drawing off this wine from the skins is easily done, and as many clean casks are filled with it as are required. The wine has at that time, to all intents and purposes completed its fermentation, although there is still left in it traces of sugar which will take a few days to ferment out. For that reason, it is not advisable that the casks which are meant to receive that newly made wine be sulphured, as sulphur fumes thwart fermentation.

The skins in turn, which after draining, still contain over two-third their weight of liquid, or about 70 per cent., are pressed. If a specially constructed press be not available, some sort of lever press, consisting of a platform and a cage to receive the skins and a beam to bring down the pressure, is put together. After a good pressing a little less than half the juice left in the skins is extracted. That juice is heavily laden with impurities, and is somewhat harsh, and it may be advisable to store it separately from the first run wine. In that case it is also placed in clean casks which have not or have been very lightly sulphured.

These two wines, the first run and the pressed, go on fermenting slowly. They are at first turbid. That turbidity is caused by the yeast cells, which are now of no use in the wine, and also by the presence of other microbes, which, if given a chance, will readily attack the wine; it is moreover caused by the presence of vegetable *débris* and other impurities.

After three weeks or so the wine will clear and it becomes advisable to proceed to the

First Racking.

As the living organisms which are now in the wine are of no more use, and may even be injurious, the partly clear wine is drawn

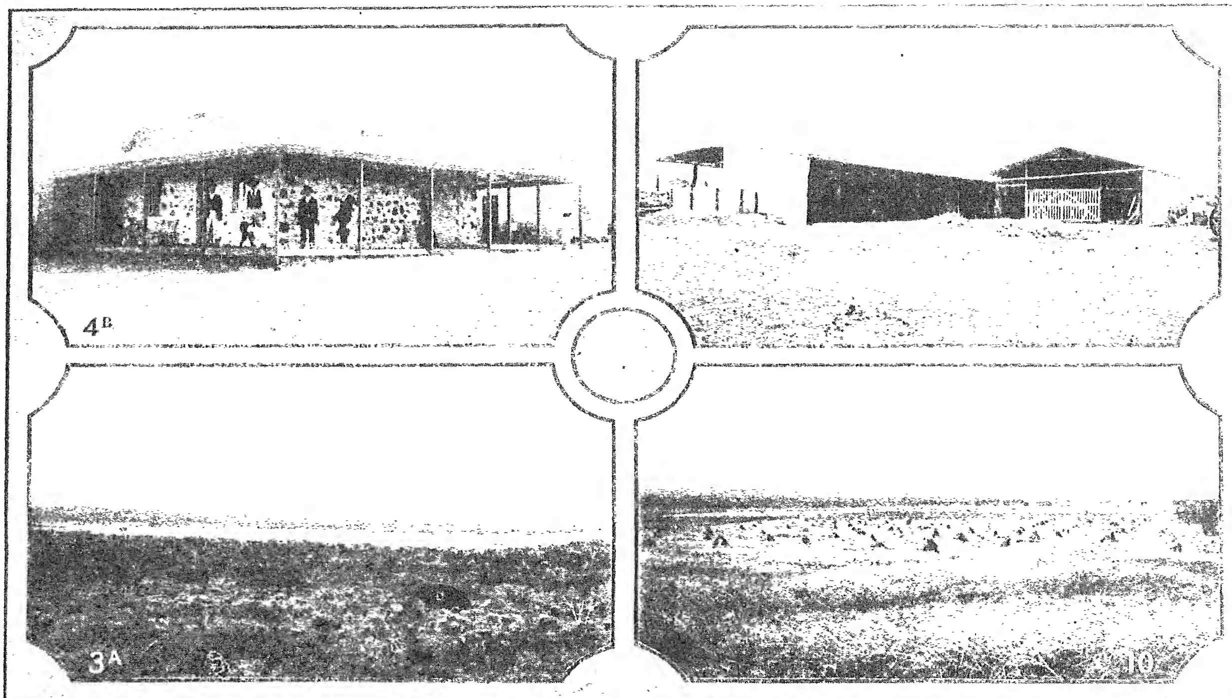


Plate I.—Experimental Farm, Chapman.

4B. Foreman's House and Students' Quarters. 2. Stables and Hay Shed. 3A. View of portions of Farm uncleared. 10. Some of the Crops.

off into a set of clean casks which have been sulphured in order to check any further working of the wine. Those casks which will receive the press wine may be sulphured more heavily than those set apart for the first run wine, or the two wines may be blended together if deemed advisable. From that time on the ullage in each cask will be refilled every week without fail, in order to exclude the air and keep the wine from going sour. Towards the end of winter, when the wine has finished clearing itself, it is usual to rack for the second time.

In another chapter I shall review the conditions favourable to the making of white wine and of sweet wines.

EXPERIMENTAL FARM.

CHAPMAN.

By Percy G. Wicken.

This farm is situated about nine miles from Bowes Siding, a platform on the railway line between Geraldton and Northampton. It can be reached from Perth by a journey to Geraldton either by train or boat, and from Geraldton a journey of 35 miles by train brings one to Bowes Siding, the remainder of the journey being done in the farm buggy, which meets the train at Bowes Siding every Friday afternoon and conveys visitors to the farm and brings them back on the following day. This farm is situated close to the Mount Erin Estate, a large estate of 60,000 acres, which has recently been purchased by the Government for the purpose of subdivision into smaller areas, and will shortly be thrown open for selection. The work carried out on this farm has done much to prove to intending settlers the capabilities of this class of soil, which is a fair type of immense areas of land in this district, and has proved that land hitherto considered of no use for cultivation can, with the application of a small quantity of fertiliser, be made to produce excellent crops.

The farm consists of an area of 1,074 acres, divided into eight paddocks, and of which area about 200 acres have been cleared and are under cultivation.

The timber consists principally of jam and wattle, which trees are of medium size and are easily cleared. A small area of York gum timber is found on one part of the estate, and this indicates some of the best of the soil. Several large areas of sand plain are included, and, as this country is generally looked on as useless, it will be interesting to watch the experiments which it is intended to carry

out on this class of country. The result of the crops grown during this season has considerably increased the value of the properties adjoining this farm.

Fig. 3A (Plate I.) gives a general view of the farm area, showing the cleared ground in the centre and the farm buildings in the distance, and is taken from the top of an adjoining hill, from which a good view of the farm is obtained.

Fig. 10 (Plate I.) gives a closer view of the area under crop, taken from just below the farm buildings, and shows the various varieties of wheat grown for experimental purposes, some of which have been harvested and others are not yet fit to cut. The principal wheats grown this season, and which have given the best results, are Queen's Jubilee, Majestic, Jade, Allora Spring, No. 67 Crossbred, No. 77 Crossbred, Clinch's Early, and Sullivan's Early Prolific. The latter has given excellent results. Oats—American Early Ripe, Garton's C, and Algerian have all done well, as also have both the barley and rye. Full reports as to the treatment and results of these tests are printed from time to time in the monthly journal published by the Agricultural Department, and a quantity of the seed of most of the varieties will be available for sale to settlers who wish to obtain good samples of seed wheat true to name. A good crop of field peas has been grown, and a number of experiments carried out. In addition to the above, a small area has been planted out with fruit trees as a start towards establishing an orchard of those varieties of fruit best suited to the district.

Fig. 4B (Plate I.) gives a view of the house provided for the foreman, to which are attached the students' quarters. The house consists of a stone building, containing four rooms and a kitchen adjoining, and at each of two corners, as shown on the left hand of the photo, are two students' rooms, making four rooms in all. Four more rooms on the other corners are now being built, and as soon as these are erected there will be accommodation for eight students. Each student is provided with a bed and the necessary furniture, and is also found his meals.

Fig. 2 (Plate I.) gives a view of the stables, cart and implement shed, and hay shed, the roofs of which are connected to the small squatter's tank shown in the left-hand corner. These buildings have been very cheaply erected.

Fig. 1 (Plate II.) shows a group of Dexter Kerry cattle, lately imported from Mr. D. Syme, of Melbourne. These are a very useful breed of cattle and, although small in size, they milk well and have been found very suitable for this district. Several more of the same class have recently been purchased in the State, and two of the young bulls have been sold. A good demand exists for the young animals of this breed for stud purposes, and before long we shall no doubt have a good stud of these animals at the farm.

Fig. 4A (Plate II.) shows the Dexter Kerry bull "Derry," also recently imported from Mr. D. Syme, and is a very good animal of his class.

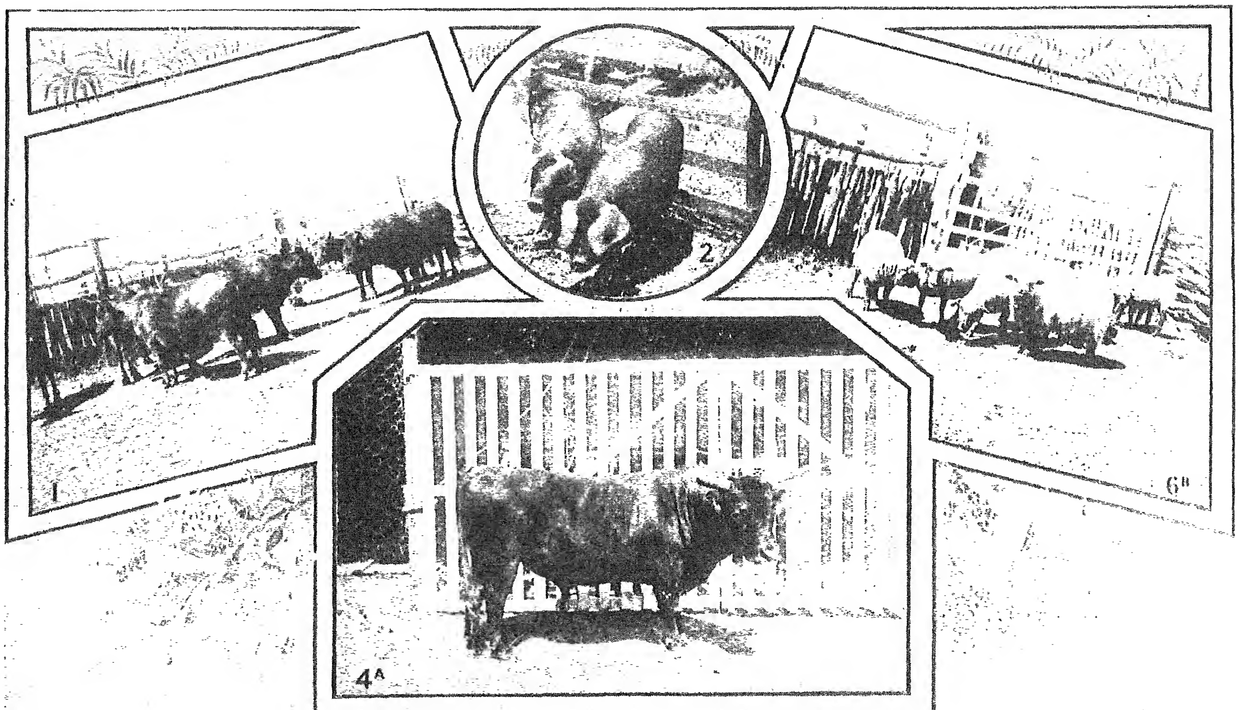


Plate II.—Experimental Farm, Chapman.

1. Group of Dexter Kerry Cattle. 2. Large Black Stud Pigs. 4A. Dexter Kerry Stud Bull "Derry." 6B. Shropshire Stud Sheep.

Special attention is being paid to sheep-breeding at this farm, and in addition to about 150 breeding ewes which are being crossed with the Shropshire rams, there is a small flock of pure-bred Shropshire sheep, from which last season some very good lambs were obtained. This flock will be added to as opportunity offers, as the breeding of pure-bred Shropshire sheep is intended to form one of the chief features of this institution. Fig. 6B (Plate II.) shows the Shropshire ewes and their lambs. These sheep have all been imported from the Eastern States and obtained prizes at the Royal Agricultural Society in 1902, at which time they were purchased.

A start has been made at pig-raising by the purchase of two young sows of the "Large Black" breed, as shown in Fig. 2 (Plate II.) A boar of the same breed has also been purchased, and as soon as the present trouble with regard to the swine fever is over further additions will be made to this department. This breed of pigs is one of the oldest breeds known, but has of late years been very much improved and come to the front again, and is regarded by many as a new breed. They attain great weights at a very early age; they are very prolific and are good grazers, and, given a fairly good grass run, will keep their condition with very little feed, and can be very easily fattened. The pigs shown in the illustration are four and a-half months old, and would weigh about 150lbs. dressed. At the present time they are allowed the run of a good sized paddock.

Fig. 6A (Plate III.) is an illustration of two sheaves of Sullivan's Prolific Wheat, a crop that has done remarkably well this season. An area of 34 acres of this crop has been harvested, the straw being about four feet six inches in height, the heads large and full of grain. The crop is very even, and should average from 18 to 20 bushels of grain and two tons of straw to the acre. This is a splendid variety of wheat, and has proved very suitable to the district, but has the objection that it sheds its grain very easily, and requires to be cut early and carted in before becoming too dry. A number of settlers who have seen this crop have expressed their determination to sow a large area of it, and already a strong demand exists for the surplus seed which we shall have to dispose of.

Fig. 6 (Plate III.) is an illustration of an experimental crop of Allora spring wheat, of which two acres were sown, and which has given very good results. The stalks averaged about four feet in height and the heads are large and full of grain. This is a very early variety of wheat, is a good yielder, and is worth a further trial.

Fig. 3 (Plate III.) shows some sheaves of the crop of "Summer Saxon" Rye, a crop that has given very good results. The straw is over 6 feet in height and the yield of grain good. If the farm was situated nearer to the capital this straw would be worth a good price for saddlers' purposes, but the distance of the farm from town is such that it would not pay carriage and cartage.

Fig. 5 (Plate III.) shows some sheaves of a crop of "Early Ripe" Oats, a variety recently introduced from America, and which has given excellent results, and would make both good hay and grain. Next year a much increased area will be sown with this variety of oats.

Plate IV. shows a few heads of the same wheat, with the grains of wheat taken out of each head; these heads are nearly five inches in length and contained 50 grains of wheat, and as 45 stalks have been obtained from a single grain, some idea of its prolific qualities may be obtained.

THROUGH FRENCH VINEYARDS.

The following interesting notes of a trip through the vineyards of France have been received by the Hon. the Colonial Treasurer from the Hon. H. B. Lefroy, C.M.G., Agent General. Mr. Lefroy, in a letter accompanying the notes, says: "Enclosed are a few notes descriptive of my recent journey to the Médoc district which may be of interest to those engaged in Western Australia in wine growing":—

"In a country like Western Australia, where the grape vine flourishes with so much luxuriance, I feel that an account of some experiences recently gained amongst the vineyards of France may be interesting, not only to those engaged in viticulture but to others who, like myself, look upon the State as being destined to become the great wine producing country of the South.

"An invitation was extended to me by Sir Walter Gilbey and Sir James Blyth to be their guest at their Chateau Loudenne in the South of France, it having occurred to these gentlemen, who have always exhibited the keenest interest in the Colonies, that it might be an advantage to the Australian representatives if they could see something of French viticulture, in view of the increased attention now being given to the possibilities of our own possessions.

"I accepted the invitation which had so kindly been extended to me as the representative of Western Australia, and have pleasure in furnishing a short report on the experiences gained during my visit, and I think that it may be found to be of interest.

"I left London in company with Sir John Cockburn and a friend of our hosts' at 9 o'clock on the night of the 1st October, and journeyed direct *via* Paris to Bordeaux, which was reached at 5 o'clock the next afternoon.

"Chateau Loudenne is only two hours by train from there, either by train or river steamer; but as neither were available at

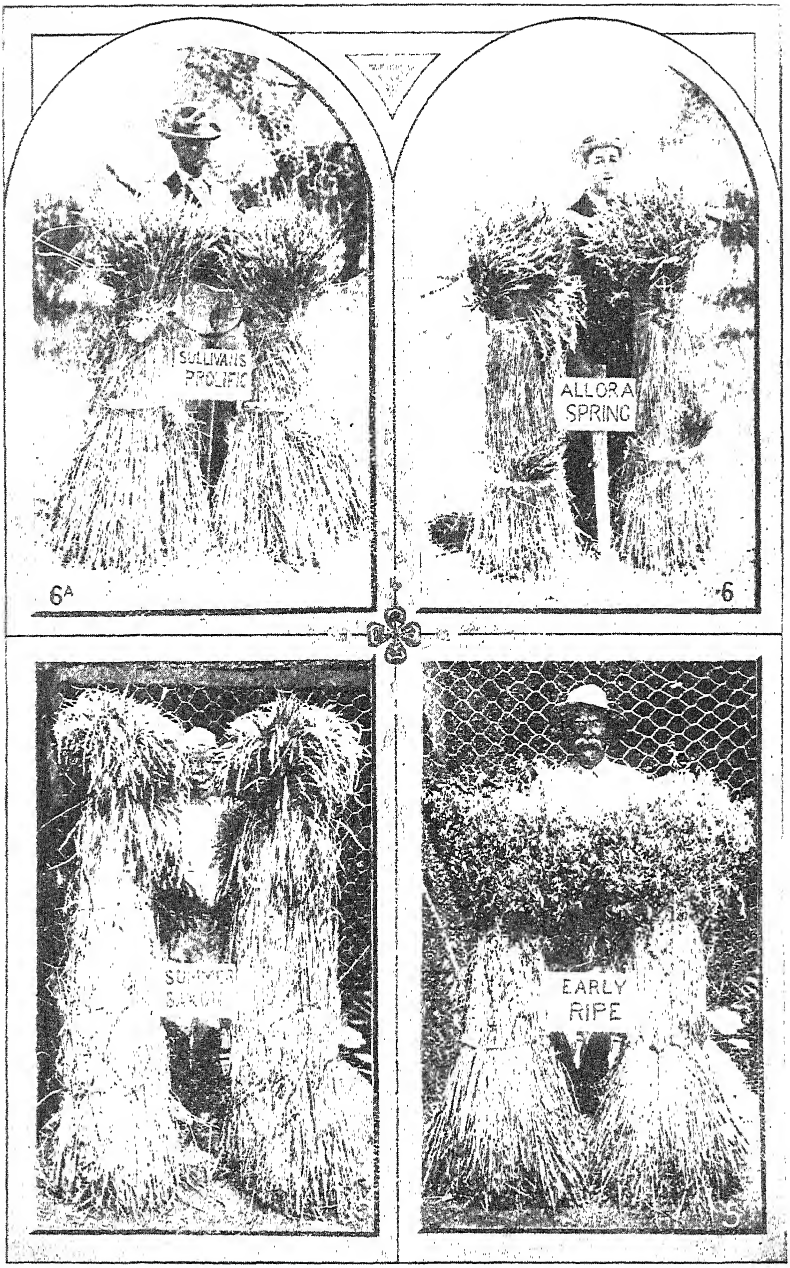


PLATE III.—Experimental Farm, Chapman.

Samples of Grain grown on the Farm.

the time, we were met by motor cars and driven to our destination, a distance of about 40 miles. We were most hospitably received, and as next day opened with glorious sunshine in a cloudless blue sky, I felt as I looked around that I was indeed in the home of the vine.

The estate of Loudenne was purchased from the Vicomtesse de Marcellus in 1875 by the firm of W. & A. Gilbey, and all wines grown or bought by the firm in the Médoc are kept on this estate, until thoroughly matured and ready for shipment to their London house.

" The surrounding country is of a gently undulating character, and on the crest of one of the low-lying hills stands Château Loudenne, situated on the boundaries of the rich district of Saint Estèphe, containing eleven of the first officially classed growths of the Médoc, among the communes, or parishes, of which are also St. Julien, Margaux, and Pauillac, the birthplaces of such wines as those of Châteaux Lafite, La Tour, and Margaux.

" To an Australian the soil of these districts does not appear rich, and is chiefly of a gravelly nature with a subsoil of clay mixed with gravel, the best wines being produced on the hills. At Château Loudenne a large amount of English capital has been brought to bear on French methods and expended in forming quite a model establishment. The vineyard, now comprising nearly 200 acres, planted with the best varieties of vines, chiefly Cabernet-Sauvignon, Malbec, and Merlot, is one of the largest in the Médoc, and yields in a good year 1,400 hogsheads of wine. The stores and cellars are very extensive and complete, and contain 16,000 casks of wine. The wines of the last crop are subjected to incessant care on the part of the chief cellarman until the following spring. The two-year-old wines are drawn off in the side buildings. Wines in their third year are kept in cool stores until fully matured.

" To start at the beginning in describing the methods I found adopted. The land is first trenched all over, two feet deep. The vine cuttings first grafted on the stock are planted in nurseries, the ground of which is specially prepared, a sandy loam being used, well manured. These are taken out after a year's or two year's growth and placed in the trenched vineyard in rows about 4ft. 6in. apart, a similar distance separating each plant, which is bedded in a small square hole filled with peaty loam, such as might be used in putting out plants of any kind. At each vine is placed a small stake about two feet out of the ground, and as the branches spread, a wire, or in some places a light wooden batten or rod is run from stake to stake to support the young growth. The vines are kept close to the ground in pruning and their runners are cut back during the spring to prevent them extending too far and drawing support from the grape, so that they show an even top about three feet from the ground. These are the methods adopted generally throughout the Médoc and are similar in most respects to those commonly adopted in Australia.

"At one time the vines were simply pruned, the land ploughed four times a year, and the grapes gathered at the vintage, leaving all else to nature and the seasons. Now from the moment the grapes are gathered, not a month passes but some process for the defence of the roots, the stems, or the leaves takes place.

"The parasites and diseases which attack the vine are numerous and known to all up-to-date Australian vignerons. Many of these have happily not reached these shores, but all these enemies are successfully fought against in France by methods which, if not known, can readily be ascertained from those works which are within the reach of everybody. As one travels about one can see the mark of the careful or careless husbandman—in France the former largely predominates—and where proper attention is used in combating the mildew, oïdium, the dread phylloxera, and other diseases, appears a healthy, even growth, well furnished with luscious fruit. The growth of phylloxera has been slower in the Gironde than further south, a fact largely due to the energetic resistance offered to its encroachments by means of bisulphide of carbon and of sulpho-carbonate of potassium. and American wild vines grafted with local plants have in many places produced excellent results.

"A country with some 4,326,000 acres under vines, producing more than a third of the wine of the globe, the production of which was, in 1900, 3,618,700,000 gallons, must command the respectful attention of vine-growers in other parts of the world, entitled as she is to educate all nations in this huge industry.

"To proceed from the vineyard to the wine press—During their progress the grapes are subjected to careful treatment, and all unripe or unsound fruit are removed from the branches. A cart drawn by bullocks conveys the grapes in large tubs to the press house. By means of a crane these are raised to the first floor and emptied into the égrappoir or movable press. On this stands a machine turned by a handle, like a machine used for winnowing corn; into this the grapes are shovelled and a revolving perforated cylinder with rakes or teeth inside separates the berries from the stalk. The former, together with the jüice, pass underneath through the perforation, when the liquid runs to the corner of the press and passes down into the vat, into which the residue is also shovelled. No further pressing takes place and the stalks are taken out of the separating machine and thrown aside. To ascertain the quantity of sugar contained a glucometer is used; it indicates exactly the density of the must and approximately the quantity of sugar it contains. By this means the most favourable moment to pick the grapes is ascertained.

"Then follows the usual fermentation and running off into casks, new casks being always used for new wine. Then comes careful attention for some months, filling up and racking off.

"At most of the vineyards I visited some little difference in the system of the treatment of the grape in the press house was found

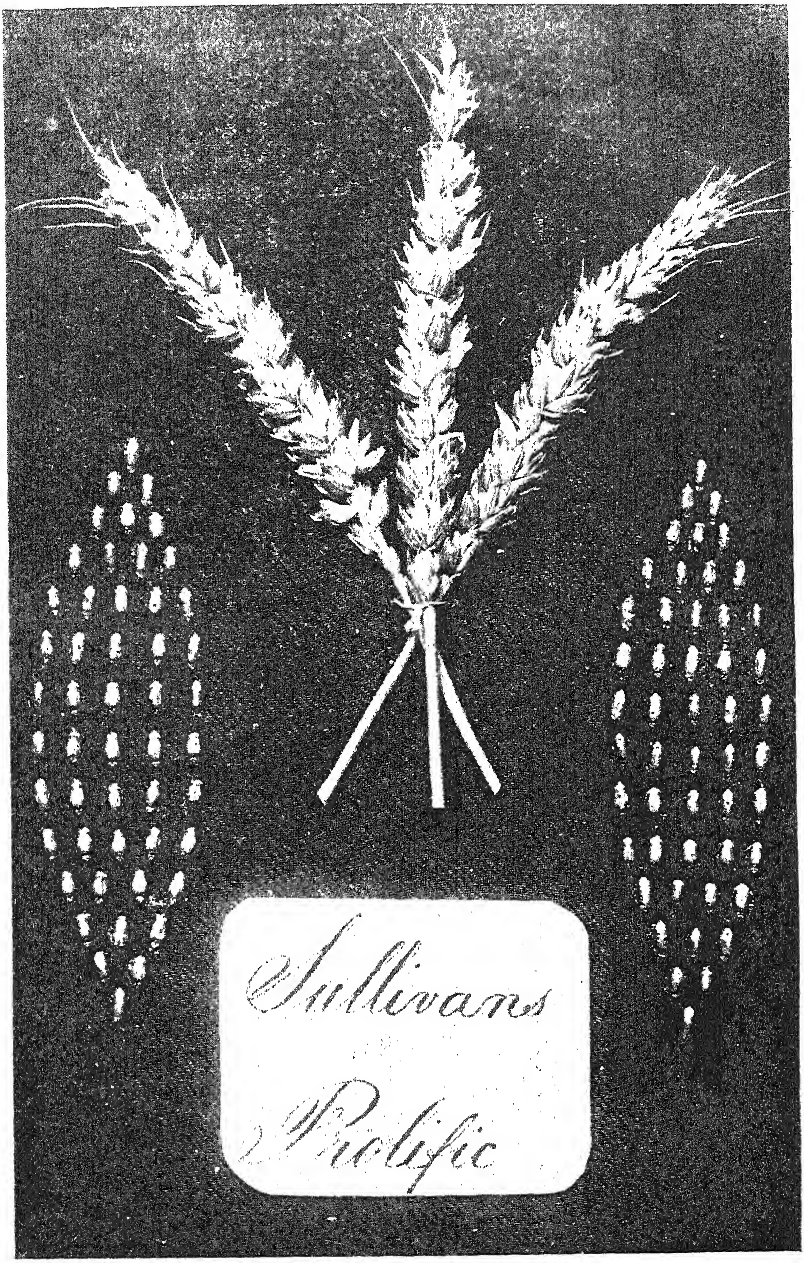


PLATE IV.—Experimental Farm, Chapman.
Showing grains from one ear of Sullivan's Prolific, grown on the Farm.

to be in vogue. In some the fruit is separated from the branches by hand, in some with rakes. In some more crushing is done than in others, and the operation is frequently performed in the old fashioned style by foot of man.

"I have now given but a short account of what came most prominently before me during my visit to this interesting country. To ensure success there must be ceaseless care and attention in the cultivation of the vine and the treatment of wine, and in no part of the world can more useful lessons be taught than in the vineyards of France. It has already been proved that Western Australia contains large areas suitable for the growth of the vine, and if I can obtain for those engaged in the wine industry any information which may be of service to them, I shall be at all times most pleased to do so. In my opinion much can be gained from the experience of France, and by adapting the methods obtaining there to Australian soil and climate.

"In conclusion, I cannot do better than quote from a pamphlet entitled "Vine culture, as exemplified at the Paris Exhibition," and written by Sir James Blyth, Bart., at the request of the London Chamber of Commerce, as a guide to wine production in the Colonies of the British Empire. Sir James writes:—

It is the application to new territories, under other skies, of the accumulated knowledge of France and other countries which will give the speediest results in the future to the enterprising vine-grower. This knowledge lies open to the enquirer everywhere, in France particularly, where the observation of sunshine, temperature, and rainfall have been most carefully observed and tabulated—would be wine-growers from all parts of the globe are certain of a cordial welcome throughout the French wine country, and equally certain of obtaining all information bearing on the culture of the vine. At Chateau Loudenne, in the Médoc, for example, which has been owned by the English firm of Messrs. W. & A. Gilbey since 1875, an accurate account of the whole quarter century has daily been kept of temperature, duration of sunshine, and extent of rainfall, all of which factors contribute to the making or marring of a vintage. Also, at every vintage time, the alcoholic strength of the separate pressings from each kind of grape—Malbec, Merlot, Cabernet Sauvignon—have been carefully tested and recorded. All these particulars are put at the service of visitors, and may be obtained and studied by those desirous of entering on vine-culture or who are already engaged in that pursuit. Reviewing in our minds the respective capabilities of our Colonies, we are inclined to look to the Australian Commonwealth for a very large contribution in the near future to the world's total supplies of light wines of the Burgundy and Claret types from black grapes, and the Hock and Sauterne types from white grapes, and the sparkling from both.

"The importation of Australian wines into the United Kingdom has increased much during the last 40 years, for whilst in 1860 it amounted to less than 1,000 gallons, it is anticipated that this year the import will exceed a million gallons, or about one-fifth of the importation from France."

"Australian wines are exhibiting the fact that they possess special merits of their own, which commend them to British consumption, and Western Australia is capable of contributing largely to the supply."

DISTRIBUTION OF PARASITES.

Report by INSPECTOR E. H. BAILEY.

Acting under instructions, I beg to submit the following report on the distribution of internal parasites and predaceous insects of different insect pests common to our State, together with a list of the colonies I have collected and sent out:—

It is gratifying to know we have now three internal parasites of the Black Scale (*L. Oleae*) strongly established. These were forwarded from Queensland and New South Wales by Mr. Compére in 1902, most of which I liberated in the gardens around Perth. The progeny of those parasites are increasing with great rapidity, puncturing the scale in all directions, and can be seen running up and down the leaves and branches, quite satisfied with their surroundings. It is not going too far in saying that the Black Scale as a pest will soon be a thing of the past here. As will be seen by my appended list a number of colonies of these parasites have been sent out since 1st December, and those who are troubled with this scale should lose no time in sending in their applications. It must be borne in mind, however, that no great results can be expected all at once; time must be allowed to enable the parasites to increase before subjugating their natural enemy.

Another parasite which we have now established is one of the soft Brown scale (*L. Hesperidum*), it having proved very efficacious. Two very useful ladybird beetles, also forwarded by Mr. Compére, are the *Rhizobius ventralis*, a scale feeder, and *Cryptolacmus moat*, which feeds on *Dactylopius* (mealy bug). These are also established with us, but so far can only be collected in limited numbers, but perhaps more will be found when I can get an opportunity to visit those places further afield where they were sent and liberated.

LADYBIRDS:

Plant aphis.—*Coccinella repanda*, three colonies supplied *Chilomenes quad*, two colonies supplied.

Cabbage aphis.—Seven colonies supplied of *Coccinella repanda* and *Chilomenes quad.*

Red spider.—Two colonies of *Scymnus vagaus.*

Red Scale.—Six colonies of *Orcus Australasiai* sent.

Black Scale.—*Orcus Australasiai*, sent nine colonies; *Rhizobius ventralis*, sent seven colonies.

This makes a total of 36 colonies of different species of ladybird beetles collected and sent away. Of these the *Rhizobius ventralis* was forwarded by Mr. Compére, and which I liberated in various gardens on arrival here. These are now established and multiplying rapidly. They were imported in 1902.

I have also collected the following colonies of internal parasites. Some of these were obtained from off the trees whilst inside of the parasitised scale, others were captured while in adult state :—

For Black Scale (*Lecanium oleac*).—Eighteen colonies collected and sent away. Three different species, all imported, forwarded by Mr. Compére and liberated in gardens round about. Now firmly established.

For Soft Brown Scale (*Lecanium Hesperidum*).—Ten colonies collected and sent away. This internal parasite is also firmly established with us now.

Diamond-backed Cabbage Moth.—Two colonies of parasitised cocoons collected and sent away.

Cabbage Aphis.—Five colonies collected and sent away. Also one colony of Syrphus fly larvæ.

All of the above parasites and ladybird beetles can now be collected for those applying. All applicants should be particular to state the scale or insect for which they need parasites.

THE GAD (OR BOTT) FLY.

By R. E. Weir, A.C.J.S.

From reports and letters received the Gad fly (commonly known as the Bott fly) is apparently becoming prevalent throughout the State, especially in the South-West. This fly has not caused much injury to stock in this State in the past, but in certain seasons, particularly after a wet winter, it has been the source of loss to owners of horses in the Eastern States.

The fly attacks the animals when grazing late in the summer months, and deposits its eggs on the hair underneath the jaw, at the knees, or on the chest, where they adhere by means of a glutinous material. From whatever cause, the animal licks those parts, some of the eggs are taken into the mouth, whence they ultimately reach the stomachs where they become firmly adhered to the walls and pass a period of several months before loosening their hold and passing through the digestive track, in due course developing into the fly.

Symptoms.

The symptoms are, falling off in condition and frequent attacks of colic, thereby showing that some irritation is present in the digestive track.

Preventative Measures.

Owners should make a careful examination of their horses during the late summer months (during which time the eggs are laid), especially of those animals which may be running loose, and to prevent the eggs obtaining access to the internal organs, they should be removed whenever discovered adhering to the hair, by washing with a solution of kerosene, hot water and soap, or an ointment of lard and kerosene rubbed on the parts.

Treatment where known or suspected to exist.

When botts are likely to be present, and there are no symptoms of pain, the following treatment should be given:—

Sulph. Iron	1oz.
Sulph. Copper	1oz.
Tartar emetic	$1\frac{1}{2}$oz.
Arsenic	1dr.

This compound should be divided into twelve parts and one administered daily. On the fourteenth day, after the animal has been prepared with mashes, a physic ball should be given from 4drs. to 8drs., depending on the size of the horse.

Nourishing food should be given, and the animal's condition improved as much as possible.

When the animal appears to be suffering, same may be relieved by administering the following drench:—

Tinc. Opium	1oz.
Spirits of Turpentine	1oz.
Linseed Oil	1pt.

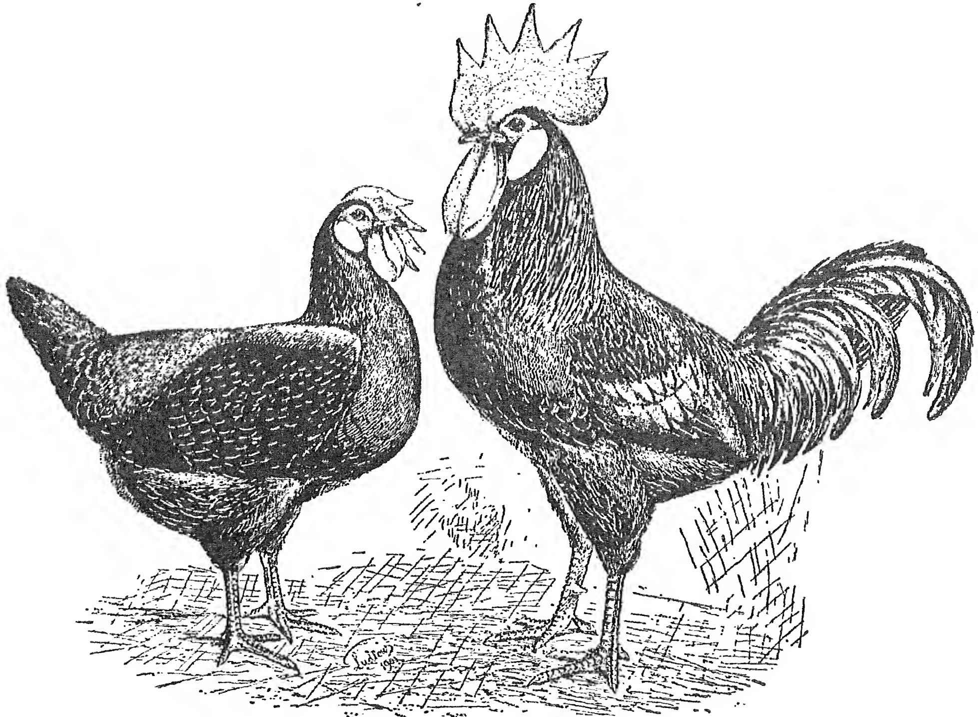
This latter may be repeated 24 hours after when necessary, and a tonic administered, if the medicine has taken effect, such as Gentian or Sulph. Iron, in doses of $\frac{1}{2}$oz. daily.

SWINE FEVER.

By R. E. Weir, A.C.J.S.

The reports to hand from the various inspectors show that swine fever is now practically eradicated in this State. Isolated cases have been reported of pigs dying, and *post mortems* made disclose the fact that the majority of these deaths are from influenza. Bacteriological examinations have failed to find any trace of the micro-organism of swine fever.

Owing to the satisfactory outlook at present it should be practicable to considerably relax the regulations within the quarantine area at an early date, and by this means, stud animals could be purchased and removed by owners requiring to do so.



MINORCAS —Types of Perfection.

POULTRY NOTES.

By Frank H. Robertson.

The Minorca.

The Minorca is one of the best known breeds of poultry at the present time, celebrated for its excellent laying qualities. There are two varieties, viz., the black and the white, but as the latter are almost unknown to Australia, anyone in speaking of Minorcas refers to the handsome pure black fowl with large combs, bright red face, pure white ear lobe, dark legs and eyes, and sprightly carriage. The accompanying illustration is a copy of the standard of perfection, as laid down by the West Australian Minorca Club, which was formed in Perth a few years ago to especially foster the breed. The club has held two shows, with satisfactory results. Still, strange to say, the Minorca fowl has of late somewhat waned in popularity, not only in Western Australia, but also in the Eastern States. It is rather difficult to arrive at the exact reason of this, but public opinion, fashion, and fancy have tides which ebb and flow in manners unaccountable. It may be owing to the appearance of so many newer varieties; the Wyandotte in particular has taken such a hold on public fancy that the Minorca has, as it were, been elbowed aside to make room for a fowl which is a good setter as well as a good layer, is not too flighty, and is very satisfactory on the table. The egg-laying competitions in New South Wales and South Australia have proved a bad advertisement for the Minorca, as in nearly ever instance where they competed their egg records have been near the bottom of the list, and again their having been such a popular fowl for exhibition purposes seems to have told against their utility qualities. The craze of late years has been for show birds to be as tall and large as possible, with great length of leg; some expensive show specimens imported from the Eastern States, which were exhibited at Perth shows, were almost as tall and big as Langshans. This breeding for fancy show points has no doubt had a detrimental effect on the egg-producing qualities, as it is but seldom that the fancier who aims at perfection in outward appearance pays any attention to egg production in the mating up of his breeding pens; he only breeds from birds of the fashionable type or style, and disdainfully discards the steady everlasting layer, because perhaps she is so short in leg, too small a comb, perhaps a spec of white in her face, or a few white feathers in her flights—all fatal defects to the critical eye of the fancier. The person who wins most prizes at shows is the person who sells most eggs and stock; the consequence is that, as a rule, not the best laying strains of the best breeds get distributed all over the country. Something of this sort seems to have happened to the Minorca, and there can be little doubt that in too many instances they are not so good

layers as they were a few years back, when I knew of a strain that laid wonderfully well. A reliable record from eight hens came out for the 12 months at the magnificent average of 219 eggs per hen per annum; this, taking weight of egg into consideration, would be hard to beat anywhere. The writer had some years back a splendid egg-laying strain of Minorcas, which, however, was much spoilt by the introduction of fresh blood of non-productive strains. No doubt there are plenty of Minorcas scattered all over the State which still retain the good laying qualities, and to those who possess such it would be advisable not to part with them, and when introducing fresh blood see that the strain is a good one. This is a difficult matter, as I never yet met a seller of fowls or eggs whose birds were not first-class layers. Appearances go a long way as a guide in this respect, and it will generally be found that the best birds are not too large, but bright and active, rather short on leg, dark, not light-coloured legs and eyes, medium-sized combs of fine texture, light in feather and fine in bone. The Minorca has, however too good a reputation to sink into obscurity, and if breeders would only pay more attention to the qualities instead of studying fancy points, the breed would soon more widely attain its former characteristics.

Fowl Cholera.

Now that the warm weather is come, poultry-breeders want to pay extra attention to one or two matters. The first is with reference to the water; let it always be given as clean and cool as possible; sunburnt and stagnant water are very liable to give fowls acute diarrhœa, dysentery, and cholera. These are all closely allied disorders of the intestines, and should be promptly dealt with. Affected fowls are listless in appearance, ruffled plumage, sunken eyes; they are very thirsty, have no appetite, the droppings are at first greenish, turning to a thin creamy substance. Birds so affected should be attended to at once, as the disease is very rapid in its course. Fowls eating putrid meat is also a frequent cause of this complaint. All drinking and feeding vessels should be disinfected, and if possible the runs should be cleaned up and scattered with quicklime, and then thoroughly slacked with water. The fowls should be isolated in cool and shady pens or sheds, and given doses of chlorodyne about every three hours. A good way of administering the medicine is to pour, say, six drops on a dry bread crumb and give to each bird separately. The most important point to remember in dealing with this complaint is prompt treatment. If any of the symptoms are noticed the bird should be at once attended to.

Protection from the Sun.

Persons keeping poultry in places devoid of shelter should supply some artificially, as during the greater portion of the day the soil is so hot that the fowls cannot stay any length of time upon it. One has only to place their hand on the soil to find the great

amount of heat it retains. The covering of the fowl's foot is but thin skin, quite unable to resist any abnormal heat. If the soil is covered with grass of any sort, or is well shaded by scrub, the fowls can move and scratch about as is their usual wont, but many poultry are kept in hot pens without shade of any sort beyond the fowlhouse, into which they have to go much against their will, because fowls have a strong dislike against occupying the same building both day and night. A simple and inexpensive mode of getting over the difficulty is to erect bough shelters, which is a very simple affair, consisting of four posts with forked tops, leaving a height of, say, three feet; lay saplings across and cover over with brush, leaving all sides quite open.

TRIAL SHIPMENT OF GRAPES TO ENGLAND.

The Hon. the Minister for Lands has for some time past been making inquiries as to the carrying out of a series of experiments in the shipment of grapes to England.

Mr. Chas. Cook, of Chidlows Well, has consented to supply certain grapes, which he states possess peculiar keeping qualities.

Mr. M. Jacoby, M.L.A., who has taken a great interest in the matter, has recommended that a case or two of the Almeria grape be sent.

The following is a copy of a report made by Mr. George Quinn, Horticultural Instructor to the Department of Agriculture of South Australia, on a trial shipment sent from that State:—

"*Re* export of Grapes to Europe.—Shipments were made by private firms during end of March and through April. No. shipments made this year through the Government Produce Depôt. Varieties sent: The varieties sent have been Red Daira (?), White Daira (Almerian export grape), Doradillo (known here as Morillion), Belas Blanco, Gordo Blanco (Muscatel), Santa Paula, Waltham Cross, and Black Malaga. Of these the only kinds which have reached London in a saleable condition have been Red Daira, White Daira, Doradillo, and Santa Paula. Of these the White Daira stands out prominently as the one variety which for six years has constantly withstood the test of the voyage. The Red Daira comes second in carrying capacity, and the Doradillo a good third. If carefully selected in loose bunches at the stage of early ripeness, the Doradillo would doubtless carry as well as any of them.

"Method of Packing.—After being slightly wilted the grapes have been packed in cases having no provision for ventilation between the battens. Both granulated cork and jarrah shavings of a fine size have been used with equally good results as packing material. The cork or shavings are shaken between and around the berries and bunches until the contents are a solid mass, which cannot move or shake down in handling.

"To whom Consigned.—The Government send all produce to their depôt, London. Private shippers send to their agents, Covent Garden, London."

Mr. Despeissis, the Horticultural and Viticultural expert to the Department, in reporting on the matter, agrees with Mr. Jacoby's suggestion that at least three cases of the Almeria grape be sent. He also states that he has brought back with him from Europe some vines of the "Colorado" grape, which is, so far as known at present, the best grape grown for export purposes.

The shipment will leave here early in April next, and the result will be looked forward to with considerable interest.

THE SPREAD OF PARASITES.

Report by T. Hooper, Chief Inspector.

About two years ago Mr. Lea, Government Entomologist at Hobart, in Tasmania, sent this Department a quantity of *Leis Conformis* ladybirds to distribute in this State for the purpose of feeding on the woolly aphis. I visited, amongst other places, Beaconsfield, near Fremantle, and liberated there a colony of about 70 of the above ladybirds in an orchard belonging to Mr. W. A. Chamberlain.

Yesterday I visited the orchard of Mr. A. Anderson at Coogee, and noticed hundreds of the ladybirds feeding on the woolly aphis there. These are the offspring of those liberated at Beaconsfield, which is five miles distant. How much farther they may have spread I cannot say, but the above is equivalent to 100 square miles of country. This is an object lesson showing how soon insects multiply and spread, and as the above is a very beneficial one it is an encouragement for the further introduction of other beneficial insects now generally spoken of as parasites.

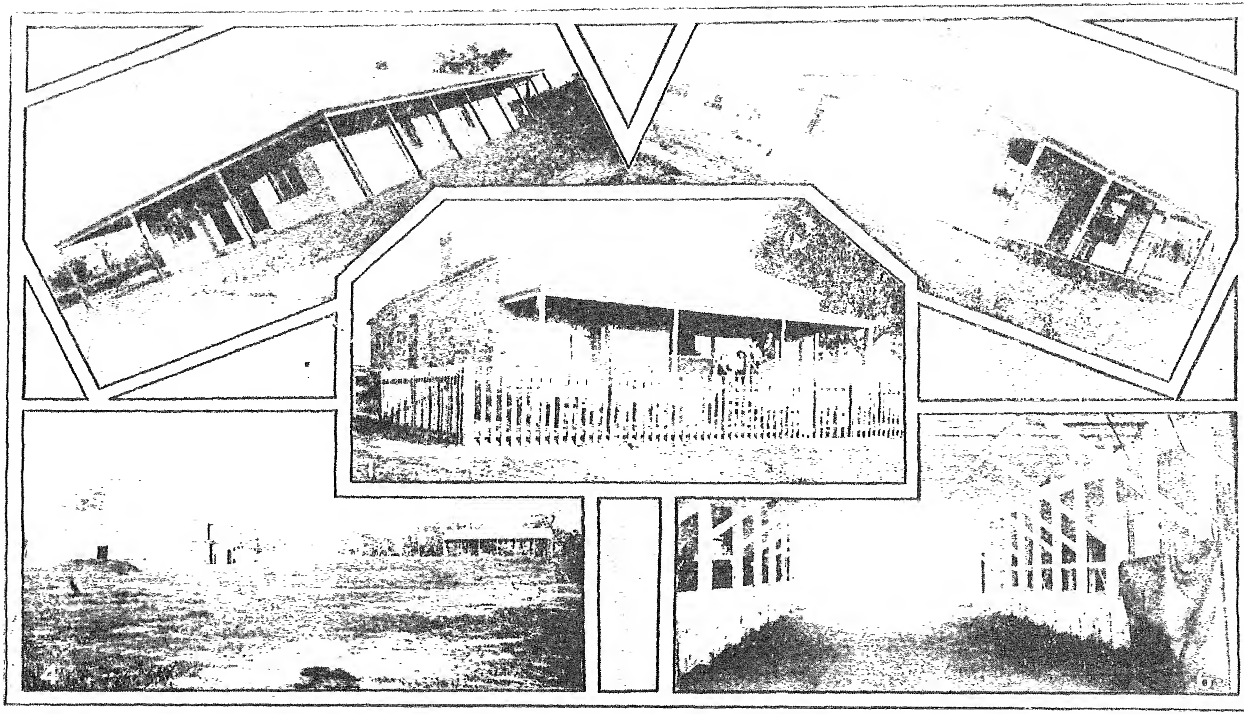


Plate V.—Experimental Farm, Narrogin.

1. Manager's House. 2. Students' Quarters. 3. Men's Cottage. 4. View showing Stables. 6. Interior of Stables and Cow Barn.

EXPERIMENTAL FARM.

NARROGIN.

By Percy G. Wicken.

This farm, at which operations were started about 18 months ago, is situated four miles on the western side of the Perth to Albany railway line at Narrogin, a distance by rail of 162 miles from Perth. Leaving Perth at 6·15 a.m. Narrogin is reached at 2 p.m., enabling the farm to be reached and inspected during the day, and a return made to the city on the day following. A visit to this farm should be made by all intending settlers, as the farm comprises all classes of soil likely to be met with in the district, and full information can be obtained as to the crops grown on the various soils, also as to the best methods of dealing with the various classes of timber, poison plants, etc., and the results of various experiments carried out.

The farm consists of an area of about 1,800 acres, which is divided into nine paddocks. About 100 acres have been placed under crop this season. The principal crops being wheat and oats, of which about 20 varieties have been grown, some of which have given very satisfactory results. A further area of about 50 acres has been cleared and fallowed for the coming season.

Nearly the whole of the area has been ringbarked, and the greater part of the timber is dead. The whole of the farm area is infested with the poison bushes, of which the principal are the York road and Box poisons. This has been eradicated from most of the paddocks, and we are now carrying stock on these areas.

There are a number of buildings erected on the farm in various styles, built of both stone and burnt bats. The buildings are plain but substantial, and meant to last, and are as cheaply built as possible to secure good workmanship.

The manager's house, shown in Fig. 1 (Plate V.), is built of granite stones, collected on the rocky hills adjoining the homestead, and consists of four rooms, kitchen, bath-room, and pantry; the walls are 16 inches in thickness, and it is substantially built, the corners, door, and window-places being built of brick; the ceilings are of small corrugated iron, and all iron and woodwork is painted. The inside walls are plastered and set, and the outside is tuck-pointed with black mortar and lined. The total cost of this building was £360.

A large building, 60 feet x 20 feet, Fig. 2 (Plate V.), with a verandah round all sides, has been erected for the accommodation of students; the building consists of one large room, 40 feet x 20 feet, with a fire-place, which will be used as a general room for the

students in the evenings, and in which the lectures will be delivered, and can also be used for any meeting, or for the reception of visitors. Four rooms, two each end of the building, each 10 feet x 10 feet, are provided for students as bedrooms. This building is built of burnt bats, *i.e.*, large bricks, made of mud, sun-dried, and then burnt. These bats are plastered on the outside with a mixture of sand and cement, and make a good cool building at a minimum of cost. The bats are made 14 inches x 6 inches x 8 inches, and are equal in size to fire-bricks. The building is plastered inside, and the ceilings are of small corrugated iron; all buildings are painted both inside and outside. A 6-feet verandah, with a gravelled floor, affords shade and protection to the building, and also a good sitting-room during the hot weather. The cost of this building has been about £260.

Two four-room cottages, as shown in Fig. 3 (Plate V.) have been erected also in burnt bats, and finished in the same style as the students quarters. One of these cottages, erected at the entrance gate, is intended to accommodate a cook, and provides one room for a kitchen and one room as a dining-room for the students, and one dining-room for the men. The second cottage is intended as a residence for the foreman. Both cottages have galvanised iron tanks of 2,000 gallons capacity so as to collect as much roof water as possible--a very important matter in these districts. The larger buildings all have underground tanks. The cost of these cottages has been about £140 each.

Fig. 4 (Plate V.) shows the barn or stable building, hay shed, and large underground tank. The barn is a stone building 60 feet x 44 feet and 16 feet high to the eaves, the lower part to a height of 10 feet from the ground is used as a stable for horses on one side and cattle on the other, the central floor being available for shearing or any other purpose. The loft, which is six feet high at the sides becoming higher under the centre, is used as a threshing floor for the smaller experimental crops of wheat. In this loft are also situated the chaff cutter, corn cracker, and grindstone, all worked by the 16 feet aermotor shown in the illustration. The chaff after cutting is passed down to a closed-in bin in the lower part of the building, and requires no bagging for our own use. A hay shed 60 feet x 38 feet is also shown in the same view, and also the piping connecting both these roofs to a large tank. This tank is built of stone and cemented on the inside, and the inside measurement is 40 feet x 16 feet x 10 feet deep, and the capacity 40,000 gallons. It has been excavated six feet below the surface, and is built four feet above the surface at the lower end, and the soil removed from the excavation banked up round the walls; it is also roofed in, and the roof connected with the tank. The cost of this tank was £55.

Fig. 6 (Plate V.) gives a view of the interior of the stable building, and provides accommodation for 10 horses on one side and 12 cows on the other. All the stalls are fitted with galvanised iron feeding troughs. The horse stalls are six feet wide by 10 feet long,

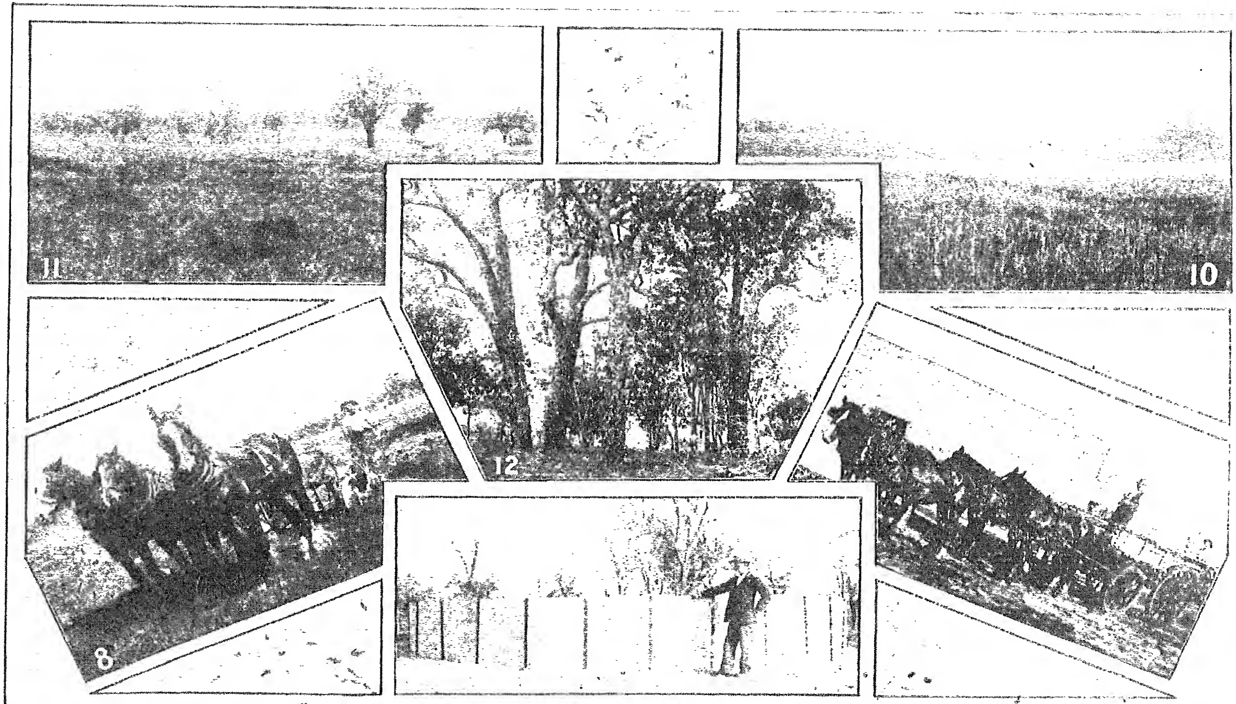


PLATE VI.—Experimental Farm, Narrogin.

7. Four Horse Team. 8. Disc Ploughing. 9. Squatter's Tank (20,000 gals.) 10. Some of the Crops. 11. Land in Fallow. 12. View of Ground before Clearing.

and the cow bails four feet wide by the same depth. The chaff is contained in the room in the right hand corner, and all the animals are fed from the front of the stalls, there being no occasion to go behind the animals for this purpose. The horse stalls are paved with stone, the rest of the floor being of puddled clay well rammed; cement would have been better, but on account of the expense this had to be left undone. The centre of the shed, with the assistance of a few hurdles, makes a good shearing floor, and shearing had just been completed at time of taking photograph.

Fig. 7 (Plate VI.) shows the front part of the stables and also the farm team of horses and wagon. All the work on the farm at present has been done by these horses.

Fig. 8 (Plate VI.) shows the stump-jump disc plough at work in some very rocky ground. These ploughs are very useful in hard rough ground, when almost impossible to plough the hard ground with an ordinary plough, we are enabled to put the disc plough and do very good work. These ploughs being stump-jumpers are very useful to new settlers, and although rather expensive in the first instance cost very little for repairs, and there are no expenses for broken shares, etc., as the large discs are not easily broken and last a long time.

Fig. 9 (Plate VI.) is an illustration of a squatter's tank. This tank consists of sheets of plain galvanised iron bolted together, a piece of hard wood is inserted inside, and a piece of flat iron outside, and when well bolted together make the joints watertight. The sheets are then put into the ground and a layer of good puddled clay about 6 inches in depth is well rammed on the bottom to make them watertight. The tank shown is 30 feet in diameter, and is composed of 30 sheets of 3-feet iron, and holds 20,000 gallons. The water is lifted from a well 75 feet deep and then forced up the hill a further height of 30 feet through 800 feet of piping by a Sampson 12-foot windmill, and is from this tank reticulated to the stables and also into several of the paddocks to provide water for stock.

Fig. 10 (Plate VI.) is a view of the area under cultivation this season, comprising about 100 acres, which are sown with wheat, oats, barley, and rye. The crops have all suffered slightly from the wet season experienced during the last winter, but, considering the season, the results must be considered very satisfactory. The soil, although not of the best and not what would be selected for the best paying results, is nevertheless very suitable for the purposes of an experimental farm, as it is very patchy and comprises all kinds of soil that can be found in the district; there is red loam, gravel, sand, and rocky patches impossible to plough through; and in the next few years the cultivation of these different areas should afford valuable information to the surrounding settlers, as to the best methods of dealing with these classes of country. For instance, the crop in the foreground of the photograph is a crop of Algerian oats, sown on a piece of poor gravelly soil, which people laughed at the

idea of ploughing up. We have plenty of this country, and have to make use of it; we therefore ploughed it deeply, applied superphosphate as a manure at the rate of 1 cwt. per acre, cost 7s., and obtained a yield of close on a ton of hay per acre, an excellent yield for this season for later sown crops. The varieties of wheat known as Baroota Wonder, Federation, No. 67 Crossbred, Allora Spring, and Early Ripe Oats all promise to give excellent results when harvested. A twelve acre piece of land has been cleared and fallowed ready for planting out in the spring as an orchard, in which a number of varieties of fruit-trees will be tested, and an adjoining block we hope to get cleared so as to enable us to test the growth of some of the summer crops in this moister soil.

Fig. 11 (Plate VI.) is a view taken on the hill at the far side of the crops shown in the previous photograph, and shows an area of cleared land fallowed for next season. To profitably farm in these districts it is necessary to have sufficient land to enable the area to be sown each year to be fallowed the previous season; if this is not done the ground becomes hard and cannot be ploughed before the rainy season sets in, and when the rain once begins the land very soon becomes too wet and it is found impossible to plough and cultivate any large area of land in the one season, the land wants to be ready for the seed drill as soon as the first rain falls. Last year, as we had only just started the farm, we had no land to fallow; this season we have progressed, and, in addition to the one hundred acres under crop, we have fifty acres of land already fallowed for next season and hope to have a considerably larger area ready to sow at that time, without working the same land as we have this year. Each year we hope to increase the area of land under crop and thereby to reduce the expenses of the farm, also to be able to supply settlers with seed-wheat true to name.

Fig. 12 (Plate VI.) gives an idea of the timber on some of this country before clearing and although not heavy in comparison with the more southern parts is still quite heavy enough to cause a good deal of hard work and expense in clearing. The timber consists principally of three sorts, white gum, jam, and red gum. The white gum timber is easily cleared, it soon dies after ringing, when once properly fired will burn right out to the end of the roots without any further trouble. The jam wood trees are small and only shallow rooted and are easily cleared. The red gum timber is the hardest to get rid of, the trees grow to a large size and are hard to kill, they take a considerable time to die after ringbarking and burn very slowly and the fires require to be constantly stirred up.

The question of dealing with this red gum country is one to which we have given considerable attention. We have tried grubbing, burning down, and pulling with a tree puller, and also of blowing them up by means of explosives, and have come to the conclusion that the latter method is by far the cheapest and best, although we are still trying grubbing the roots. The explosive used is gelignite which we find cheap and very effective. An auger hole is made with a two-inch auger in the tree about 12 or 15 inches

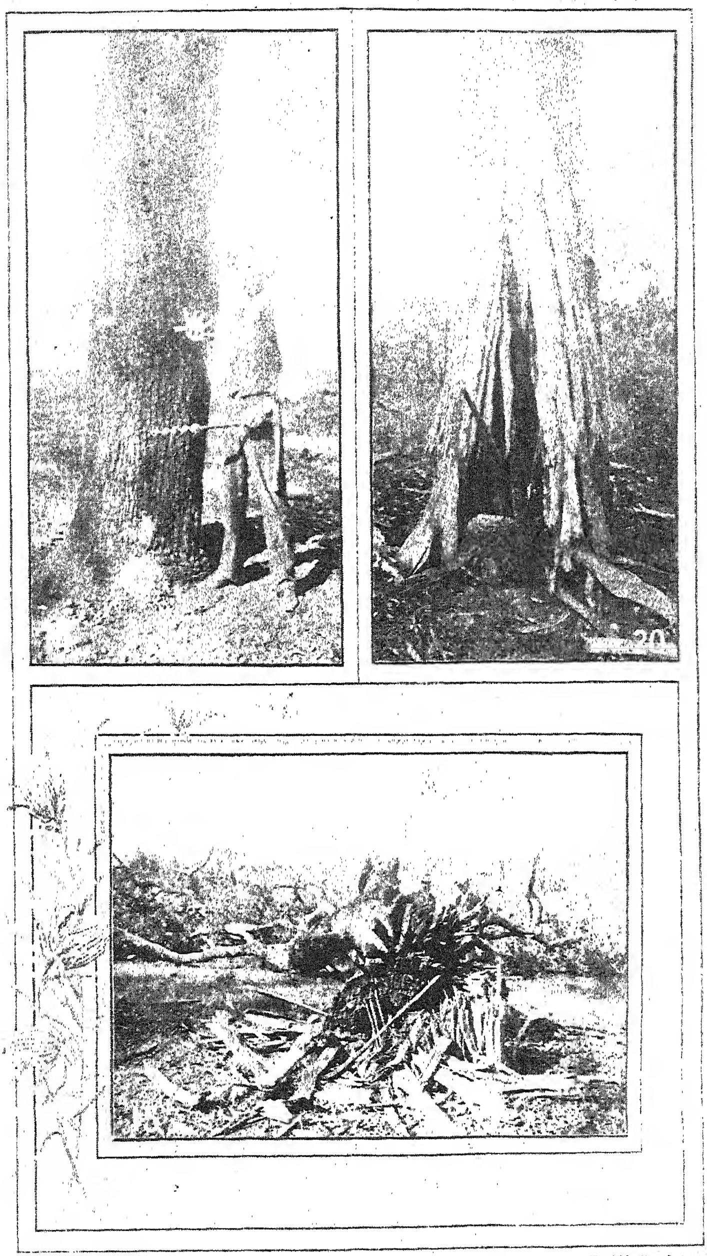


PLATE VII.—Experimental Farm, Narrogin. Clearing Heavy Timber by means of Gelignite.

14. 8ft. Red Gum before Charging. 15. Same afterwards. 20. Red Gum after Blasting.

from the ground, and a number of plugs of gelignite, according to the size of the tree, are inserted and then fired. Fig. 14 (Plate VII.) shows a red gum tree eight feet in girth, for which six plugs of gelignite were used, and the cost of explosives and labour amounted to 1s. The following photo, Fig. 15 (Plate VII.), shows the same tree a few seconds afterwards, in which it will be observed that the heavy part of the trunk, and also the roots of the tree, are splintered to matchwood, and when left to dry in this condition for two or three months, as we intend doing, will burn very easily without the necessity and stacking large quantities of small wood around the butts of the tree.

Fig. 16 (Plate VIII.) shows a larger tree in which eight plugs of gelignite were used, and the cost of bringing the tree down 1s. 4d. The following photo, Fig. 17 (Plate VIII.), shows the same tree a few seconds afterwards, in which it will be observed that the roots are completely shattered. The same tree could not have been grubbed in the ordinary way for 10s.

Fig. 18 (Plate VIII.) shows a red gum which required burning off, and Fig. 19 (Plate VIII.) the same log after the charge of four plugs of gelignite had been exploded at a cost of 6d.; the log is completely shattered and will now burn without any further trouble.

THE SCIENTIST AND THE FOOD PROBLEM.

By Ray Stannard Baker.

The following very interesting article is taken from *Harper's Magazine*:—

"It has been said that mankind is never more than three months removed from abject starvation—an old truth that must always be new and startling. That is, if all resources of food production in the world should be suddenly cut off—the wheat fields failing to give forth their usual crops, and the pastures withering under the feet of the flocks and herds,—the existing store of food would supply mankind barely a quarter of a year, and even before that hunger would have pinched thousands of the poor. In this day of overflowing abundance such a statement as this comes with something like a shock; it shows by how fine a thread the life of mankind is suspended.

"It has been pointed out by the pessimistic philosopher that the wheat fields of the world are failing year by year,--slowly, it is true, but failing; that in many countries the land is being "cropped to death," and already we are hearing of worn-out land

in Dakota—the paradise of the wheat-producer. The problem, therefore, as seen by these pessimists, is simple: The world is reaching the limits of its capacity for food production, while the population continues to increase enormously: How soon will starvation begin?

"While these philosophers have been making dire predictions, however, science has been quietly but perseveringly at work to prove that mankind has only just begun to sound the world's capacity for food production, and that it is practically limitless. The mistake of the pessimists has been that they have based their arguments on the present knowledge of soil culture, forgetting that science might make discoveries which would change every condition and suggest entirely new possibilities.

"Somehow, when man seems just at the limit of his resources, science and invention step in and open new fields, literally as well as figuratively. A comparatively few decades ago no one had thought of using artificial fertilisers; now a young man in Paris is putting up fertilisers in little pressed tablets, a different kind for each different plant. They are accompanied by directions indicating how often the doses must be given and at what times. This, of course, is the extreme application of a new system; but the manufacture of artificial fertilisers for supplying the soil with just the elements that it needs to produce large crops has now become a great business enterprise, and with a constantly decreasing cost of manufacturing power; the harnessing of waterfalls like Niagara, the use of the tides, and the possibility of the direct application of the energy of the sun promise still cheaper fertilisers and still smaller expense of transporting them to the farmer. All this will tend to maintain and even to increase food production. And then there is the possibility, and it is now more than a possibility, of making artificial food outright—that is, of combining the familiar chemical elements of which food is composed and producing a food substitute that will sustain life.

"No one need go farther than the laboratory of Professor Berthelot of Paris to be convinced of the great possibilities in this branch of scientific activity. The work is already under way, and science stands ready, the moment the world lacks a complete dinner, to help out with wonderful new food products harvested from retorts and crucibles.

"I have barely mentioned these two branches of scientific effort to lead up to the wonderful experiments of Professor Nobbe of Germany—experiments which give an insight into the unfathomed possibilities which lie at the hand of the scientific investigator.

"Tharandt, in Saxony, where Professor Nobbe has carried on his investigations for over 30 years, is a little village set picturesquely among the Saxon hills, some half-hour's ride by railroad from the city of Dresden. Here is located the Forest Academy of the kingdom, with which Professor Nobbe is prominently connected, and here also is the agricultural experiment station of which he is

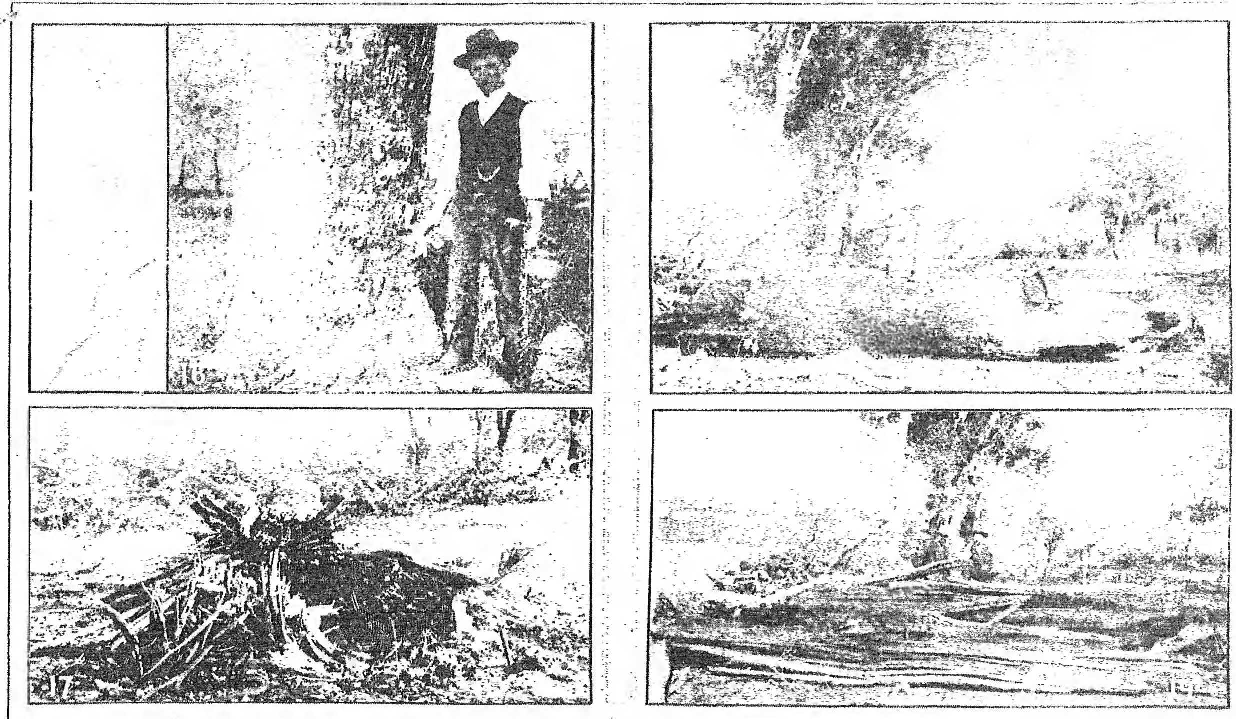


PLATE VIII.—Experimental Farm, Narrogin. Clearing Heavy Timber by means of Gelignite.
16. Before Charging. 17. After Explosion. 18. Old Log being shattered. 19. Same afterwards.

director. He has been for more than forty years the editor of one of the most important scientific publications in Germany, he is chairman of the Imperial Society of Agricultural Station Directors, and he has been the recipient of many honours. But the greatest of all his work is his remarkable discovery of a method of inoculating the soil with bacteria to make it yield richly where it lay barren before. In times past investigators of soil and plant culture devoted their attention largely to studying the composition of various kinds of soil, to the improvement of fertilisers, and in suggesting new systems of drainage and water-supply. Professor Nobbe has gone a step farther in advance, declaring that plants will grow, under certain conditions, just as well without soil as with soil. At first glance this may seem strange enough, yet here are trees, from eight to 10 inches in circumference at the base of the trunk, growing in clean water, without a sign of soil of any description. They stand in rows just back of the Forest Academy and near Professor Nobbe's greenhouse. Each tree is suspended in a large glass jar surrounded by a green-painted case. When this case is opened one may look through the glass and see the roots of the tree hanging there in the clean water. The oldest of the trees was planted, or rather the seed was immersed in water, in 1878, and it has grown to full size without even touching soil. Leaves and blossoms have come in the spring, and in the winter the water and the roots have frozen solid all these years, and the tree still thrives. Indeed, some of its seeds were immersed in water, and the trees of the second generation have been grown to considerable size. Then their seeds were immersed, and there are now growing small trees three generations removed from the soil—certainly a clear proof of Professor Nobbe's assertion that actual contact with soil is not essential for plant growth. In order to produce such results, however, it was necessary to keep the trees supplied with artificial food. This Professor Nobbe prepared in his laboratory—a certain definite amount of chlorate of potash, sulphate of magnesium, phosphate of iron, phosphate of potassium, and a nitrate. A small quantity of this mixture was dissolved in the water of the jars every four weeks, and thus the trees have been kept flourishing all these years, showing that there was no element in the soil necessary to plant growth that man could not manufacture at will.

"Nor was this all that the experiment showed. Professor Nobbe knew to the last gramme how much food he had given to the plant through the water; he also knew that the water before adding the chemicals named was absolutely pure; yet when he came to analyse some of the plants thus grown he found that they contained much greater quantities of various elements than he had supplied through the water. This constituted a proof positive that the plant drew largely upon the air for its nourishment—a fact well-known to science, but not before positively and quantitatively demonstrated. The proportion of substance drawn from the air was found to be very large. It is said that of every one hundred pounds of wheat harvested from our fields barely one pound is actually drawn from the soil, the remainder coming from the free

air and the water. And yet the effort to supply this one-one-hundredth of the plant's food has caused most of the wars and conflicts of the world, has led to the discovery and settling of new continents, and forms to-day the foundation of commerce and finance.

"As soon as science had convinced itself of the great truth that plants are fed largely from substances in the air, it began at once to study the problem as to *how* the plant is able to appropriate this aerial food. The chief chemical elements in all vegetable substances are oxygen, carbon, hydrogen, and nitrogen. Added to these are small quantities of potassium, phosphorous, iron, sulphur, magnesium, and calcium. Of all these elements the only ones about which there is any difficulty are nitrogen, potassium, and phosphorous. The others the plant obtains without difficulty, but the supply of nitrogen, especially, too often runs short. When land is said to be worn out, the meaning is that the supplies of nitrogen, potassium, and phosphorous have been exhausted by too constant cropping, by taking much away from the soil and returning nothing to it.

"Manure and fertilisers which are rich in these lacking elements, especially those which, like barn-yard manure, are rich in nitrogen, are thus applied to the land, thereby restoring its producing capability. Nitrogen is the all-important element. Potassium and phosphorus are usually present in abundance, or they can be easily supplied in the form of wood-ashes and other fertilisers, but nitrogren is more expensive and more difficult to restore. Nitrogen is what makes the muscles and brain of a man; it is the essential element of all elements in the growth of animals and plants; and, significantly enough, it is also the chief constituent of the gunpowder and other explosives with which the wars of the world are waged. A single discharge of a 13-inch gun liberates enough nitrogen to produce many scores of bushels of wheat. This fact may become, in the future, a greater deterrent of war than we can now imagine.

"The failure of the nitrogen of the soil and the inability to supply it in sufficient quantities by artificial means has formed the basis of the predictions of coming starvation made by Sir William Crookes and others. Indeed, if the world ever starves it will be from lack of nitrogen; and yet if such starvation takes place it will be in a world full of nitrogen. For there is not one of the elements more common than nitrogen, not one present around us in larger quantities. Four-fifths of every breath of air we breathe is pure nitrogen—four-fifths of all the earth's atmosphere is nitrogen. If mankind dies of nitrogen starvation, it will die with food everywhere about it and within it.

"But, unfortunately, plants and animals are unable to take up nitrogen in its pure form as it appears in the air. It must be combined with nitrogen in the form of ammonia or in some nitrate. These facts have been well known to science for many years. At the same time it has been known, as a matter of experience among

farmers, that when land is worn out by overcropping, with wheat or oats, for instance, both of which draw heavily on the earth's nitrogen supply, certain other crops will still grow luxuriantly upon it, and that if these crops are left and ploughed in, the fertility of the soil will be restored, and it will again produce large fields of wheat and other nitrogen-demanding plants. These restorative crops are clover, lupin, and other leguminous plants—a classification including beans and peas. Everyone who is at all familiar with farming operations has heard of seeding down an old field to clover, thereby restoring its fertility in a degree.

"The great importance of this bit of the wisdom of experience was not appreciated by science for many years. Then several German experimenters began to ask why clover and lupin and beans should flourish on worn-out land when other crops failed. All of these plants are especially rich in nitrogen, and yet they grow well on soil which has been robbed of its nitrogen? Why was this so?

"It was a hard problem to solve. Botanists had already discovered that the roots of the leguminous plants—that is, clover, lupin, beans, peas, and so on—were usually covered with small round swellings, or tumors, to which were given the name nodules. The exact purpose of these swellings being unknown, they were set down as a condition, possibly, of disease, and no further attention was paid to them, until Professor Hellriegel of Burnburg, in Anhalt, took up the work. After much experimenting, he made the important discovery that lupins which had nodules would grow in soil devoid of nitrogen, and that lupins which had no nodules would not grow in the same soil. It was plain, therefore, that the nodules must play an important though mysterious part in enabling the plant to utilise the free nitrogen of the air. That was early in the 80's. His discovery at once started other investigators to work, and it was not long before the announcement came—and it came, curiously enough, at a time when Dr. Koch was making his greatest contributions to the world's knowledge of the germ theory of disease—that these nodules were the result of minute bacteria found in the soil. Professor Beyerinck of Münster gave the bacteria the name Radiocola.

"It was at this time Professor Nobbe took up the work with vigour. If these nodules were produced by bacteria, then the bacteria must be present in the soil; and if they were not present, would it not be possible to supply them by artificial means? In other words, if soil, even worn-out farm soil,—or, indeed, pure sand, like that of the seashore,—could thus be inoculated, as a physician inoculates a guinea-pig with anthrax germs, would not beans and peas planted there form nodules and draw their nourishment from the air? It was a somewhat startling idea; but all radically new ideas are startling, and after thinking it over, Professor Nobbe began, in 1888, a series of most remarkable experiments, having as their purpose the discovery of a practical method of soil inoculation. He gathered the nodule-covered roots

of beans and peas, dried and crushed them, and made an extract of them in water. Then he prepared a gelatine solution with a little sugar, asparagine, and other materials, and added the nodule extract. In this medium colonies of bacteria at once began to grow—bacteria of many kinds. Professor Nobbe separated the Radiocola—which are oblong in shape—and made what is known as a "clean culture,"—that is a culture in gelatine consisting of billions of these particular germs and no others. When he had succeeded in producing these clean cultures he was ready for his actual experiments in growing plants. He took a quantity of pure sand, and in order to be sure that it contained no nitrogen, nor bacteria in any form, he heated it to a high temperature three different times for six hours, thereby completely sterilizing it. This sand he placed in three jars. To each of these he added a small quantity of mineral food—the required phosphorus, potassium, iron, sulphur, and so on. To the first he supplied no nitrogen at all in any form; the second he fertilised with saltpeter, which is largely composed of nitrogen in a form in which plants may readily absorb it through their roots; the third of the jars he inoculated with some of his bacteria culture. Then he planted beans and awaited the results,—as may be imagined, somewhat anxiously. Perfectly pure sterilised water was supplied to each jar in equal amounts. The seeds sprouted, and for a week the young shoots in the three jars were almost identical in appearance; but soon after that there was a gradual but striking change. The beans in the first jar, having no nitrogen and no inoculation, turned pale and refused to grow, finally dying down completely—starved for want of nitrogenous food, exactly as a man would starve for the lack of the same kind of nourishment. The beans in the second jar, with the fertilised soil, grew about as they would in the garden, all of the nourishment having been artificially supplied; but the third jar which had been jealously watched, showed really a miracle of growth. It must be remembered that the soil in this jar was as absolutely free of nitrogen as the soil in the first jar, and yet the beans flourished greatly, and when some of the plants were analysed they were found to be rich in nitrogen. Nodules had formed on the roots of the beans in the third or inoculated jar only, thereby proving beyond the hope of the experimenter that soil inoculation was a possibility, at least in the laboratory.

"With this favourable beginning Professor Nobbe went forward with his experiments with renewed vigour. He tried inoculating the soil for peas, lupin, vetch, acacia, robinia, and in every case the roots formed nodules, and although there was absolutely no nitrogen in the soil, the plants invariably flourished. Then Professor Nobbe tried great numbers of difficult test experiments, such as inoculating the soil with clover bacteria, then planting it with beans or peas, or *vice versa*, to see whether the bacteria from the nodules of any one leguminous plant could be used for all or any of the others. He also tried successive cultures—that is, bean bacteria for beans for several years—to see if better results could be obtained by continued use. An outline description

of all the experiments which Professor Nobbe made in the course of these investigations would fill a small volume, and it will be best to set down here only his general conclusions.

"These wonderful nitrogen-absorbing bacteria do not appear in all soil, although they are widely distributed. So far as known they form nodules only on the roots of a few varieties of plants, mostly leguminous.

"In their virginal form in the soil they are neutral—that is, not especially adapted to beans or peas or any one particular kind of crop. But if clover, for instance, is planted, they straightway form nodules, and become especially adapted to the clover plant, so that, as every farmer knows, the second crop of clover on worn-out land is much better than the first. And curiously enough, when once the bacteria have become thoroughly adapted to one of the crops—say, beans—they will not affect peas or clover, or only feebly.

"And a strange feature of the life of these little creatures, which has a marvellous suggestion of intelligence, is their activity in various kinds of soil. When the ground is very rich—that is, when it contains plenty of nitrogenous matter—they are what Professor Nobbe calls 'lazy.' They do not readily form nodules on the roots of the plants, seeming almost to know that there is no necessity for it. But when once the nitrogenous matter in the soil begins to fail, then they work more sharply, and when it has gone altogether they are at the very height of their activity. Consequently, unless the soil is nearly worn out or very poor to begin with, there is no use in inoculating it: it would be like 'taking owls to Athens,' as Professor Nobbe says.

"Having thus proved the remarkable efficacy of soil inoculation in his laboratory and greenhouses, where I saw great numbers of experiments still going forward, Professor Nobbe set himself to make his discoveries of practical value. He gave to his bacteria cultures the name 'Nitragen'—spelled with an a,—and he produced separate cultures for each of the important crops—peas, beans, vetch, lupin, and clover. In 1894 the first of these were placed on the market, and they had a considerable sale, although such a radical innovation as this, so far out of the ordinary run of agricultural operation, and so almost unbelievably wonderful, cannot be expected to spread very rapidly. The cultures are now manufactured at one of the great commercial chemical laboratories on the river Main. I saw some of them in Professor Nobbe's laboratory. They were put up in small glass bottles, each marked with the name of the crop for which it is especially adapted. The bottle was partly filled with the yellow gelatinous substance in which the bacteria grow. On the surface of this there was a mossylike gray growth, resembling mould. This consisted of innumerable millions of the little oblong bacteria. A bottle cost about fifty cents, and contained enough bacteria for inoculating half an acre of land. It must be used within a certain number of weeks after it is obtained.

while it is still fresh. The method of application is very simple. The contents of the bottle are diluted with warm water. Then the seeds of the beans, clover, or peas, which have previously been mixed with a little soil, are treated with this solution and thoroughly mixed with the soil. After that the mass is partially dried so that the seeds may be readily sown. The bacteria at once begin to propagate in the soil, which is their natural home, and by the time the beans or peas have put out roots they are present in vast numbers, and ready to begin the active work of forming nodules. It is not known exactly how the bacteria absorb the free nitrogen from the air, but they do it successfully, and that is the main thing. Many German agriculturists have tried Nitragen. One, who was skeptical of its virtues, wrote to Professor Nobbe that he sowed the bacteria-inoculated seeds in the form of a huge letter N in the midst of his field, planting the rest in the ordinary way. Before a month had passed, that N showed up green and big over all the field, the plants composing it thriving so much better than those around it.

"Prompted by these experiments, a valuable series of tests has recently been made by the United States Department of Agriculture, and an improved method for distributing the bacteria has been devised. Instead of a moist culture in glass tubes the bacteria are put up in a small dry mass that resembles a yeast-cake. These may be sent anywhere without deterioration; a little soaking is all that is needed to prepare them for use in the soil. The department is now formulating a plan for introducing these cultures extensively in localities in this country which are deficient in nodule-forming germs.

"But the farmer must know the exact disease from which his land is suffering before he applies the remedy. If it is deficient in the phosphates, bacteria cultures will not help it, whereas if it is deficient in nitrogen, bacteria inoculation is just what it needs."

Soil Inoculation.

With reference to the above, the following article on soil-inoculation will be read with interest:—

"If we accept the results, says a writer in London *Field*, of the experimental work which has been conducted at the agricultural station at Ems as indicative of what is possible on other soils than those which have been under test for the past fourteen years, we are bound to believe that the principle of inoculating soils will enable many occupiers and others to grow successful crops upon land which at the present moment is regarded as practically useless.

"The soil in question is of a peaty character, and, except under the process which has been followed so long by Dr. Salfield, the Director of the Station, it has been useless. It is needless to say that the system adopted is based upon the results of the discoveries

of Hellriegel and his collaborator Wilfarth, and that it was argued in the first place, by those who had been responsible for the work, that just as the leguminous plant in the test pot failed to grow in the absence of necessary soil bacteria, so do the common leguminous plants of the field, clovers, and the like, fail from the same cause.

"The first attempt to obtain good results by inoculation was made in 1887. This was so successful that it has been followed by work of an experimental character in the same direction for a number of years, fertile soil from a field which has carried a specific crop, such as clover, being distributed on the soil of an infertile field, and supplemented by dressing of phosphoric acid and potash.

"Dr. Salfield has found that given soils which have been tested and which have refused to grow a crop, have responded when they have been inoculated by soils taken from a field in which this crop has been grown successfully, but that they have only proved fertile for this particular family. In these cases, he has employed dressings of phosphates containing 80lb. of phosphoric acid, given in the form of basic slag, per acre, and 120lb. of potash, given in the form of kainit.

"The soil in question being of a peaty or turfy character, were either marled or chalked at the commencement of the series. It may be suggested here that these soils have been treated by the experimenter as mere mechanical media or vehicles for the feeding of plants with the four most valuable plant foods supplied at the hands or through the medium of the cultivator himself. They apparently were well stocked with all the constituents of plants, but the three chief minerals, phosphoric acid, potash, and lime and nitrogen, which last was obtained from the atmosphere by the help of the bacteria supplied in the soil inoculation.

"It may be asked whether the soil is of any value if it becomes necessary to feed it in this way, but in the main even the best soils are vehicles of the same character, for, unless they are systematically maintained by artificial manuring, they, too, would become infertile, and under all systems of good farming it is essential to supply the same minerals, or, at all events, two of the same minerals, and for all crops but the leguminosæ, nitrogen as well.

"With regard to the quantity of soil used for inoculating, Dr. Salfield found that from two to four tons per hectare of two and a-half acres was sufficient, but everything depends upon the care with which the work was accomplished. He tells us that, in accordance with the hypothesis of another expert, and his work confirms the hypothesis, bacteria are not endowed with sufficient motive power to transport themselves even a very small distance from the point at which they are introduced into the soil, and therefore, as it is essential for them to come into contact with the roots of the young plants, so it is essential that the soil of inoculation should be extremely fine and very perfectly distributed.

"After broadcasting, therefore, the soil is harrowed not only with the object of making its distribution more perfect, but of introducing it beneath the soil, so as to come more directly in contact with the young roots. He places the average depth which he finds most desirable, to be within the first 5½in. in, and it is also a condition that the soil should not be absolutely dry, inasmuch as the vitality of the bacteria are then impaired.

"Such, at all events, is the teaching which is the result of several years' experimental work. When the question is thought out, it would almost appear that where seed is drilled (and in this case I refer more especially to the larger seed, such as peas and beans, and perhaps, to lucerne and sanfoin as well) more perfect results might be obtained if the soil could be drilled with it, thus ensuring actual contact, but in any case the distribution of the soil of inoculation must not be delayed after the seed is sown.

"Reference has been made to the supply of mineral fertilisers and lime, which may, perhaps, be classed under the same head. Every grower of clover is aware of the importance of lime and of phosphoric acid, and therefore it should not be necessary to point out, although some reference must not be omitted to the fact that a soil is not fertile if it is deficient in one constituent.

"A soil, therefore, which is absolutely poor in either phosphoric acid, potash, or lime must be supplied with each and all, for there can be no growth, however abundant other constituents may be, where one is absent. If the bacteria are able to assimilate free nitrogen and supply it to the plant in the practical absence of the mineral mentioned, it is evident that the plant itself cannot appropriate the nitrogen which is placed at its disposal, inasmuch as its structure cannot be built without their aid.

"It may, lastly, be pointed out that where soil possesses a useful mechanical condition, where it is drained, for example, and where it does not suffer from drought in summer, the above teaching suggests that it may be employed with profit by the adoption of the same method which has enabled so many Germans to bring sands and peat into successful cultivation. Where clover can be grown cereals can follow: where lucerne can be grown a crop may be ensured for years, and land hitherto worth a mere nothing for sheep or rabbits, may be induced to provide green crops for cattle, and, subsequently, corn and root crops."

BEE NOTES.

By F. L. Morrill.

A Bad Case of Robbing.

HOW IT WAS STOPPED BY KILLING THE ACTUAL ROBBERS WITH A KEROSENE TORCH.

This experience is probably what others have gone through before, and I give it thinking it may be useful to some one who may at some time be in the same predicament that I was in a few weeks ago. Just prior to the time I speak of this locality was visited by a hot north wind. The heat was intense, and as I had shade boards over all the hives I thought none of the combs would melt down, and being busy with other work I did not visit the bees for several days. When I did I found the apiary in confusion. The bees were crazy, and began stinging before I came within a quarter of a mile of them. The air was full of mad stinging bees. I soon found that it was the worst case of robbing I had ever heard of. The whole yard of 180 colonies was demoralised. Some of the combs had melted in the extracting-supers, and as it was at a time of the year when there was no flow of honey it set the bees to robbing. I did not dare to close the hives up entirely on account of the heat, but I immediately closed the entrance, so that only one bee could go in at a time, and then I tried everything that I had ever heard of to stop robbing, but with no success. I flooded the robbers with water. I smoked them with sulphur smoke where they gathered on the hives. I exchanged the hives after dusting the bees to see where the robbers went to, but they only began to rob their own hives back again. They would pounce on a strong colony and go right in, no matter what the resistance.

I went home at night ready to sell cheap or give away every colony I had in the yard. After thinking the matter over I became convinced that, if I saved the bees, I must kill the robbers. The next morning I procured a brazing torch, such as painters use to burn off old paint, and, taking a supply of gasoline, I went for the robbers. I went from hive to hive, throwing the flame on them as I went, wherever I found them trying to get in. They were gathered in great bunches on the now one-beeway entrances. I soon had to cover my hands, as this seemed to make them so mad that they would tackle even the torch. They objected to having their wings burned off, but I was in no mood for leniency. I worked nearly all day in this manner, and along in the afternoon had things somewhat quiet again.

The next morning I used a kerosene-torch with just as good results, but I did not find many robbers, and the next day things were in normal shape again.

You may say that it was too bad to kill so many bees, and that it was a cruel way to do; but had I not done so I should have lost many colonies, and the loss of bees was no matter, as they were only consumers, there being no flow of honey, and no probability of any until fall. In using the coal-oil torch, care should be used so as not to let it get too hot, as it might explode.

[It is no doubt true that, when there is a bad case of robbing on, only a *comparatively* few robbers are engaged in the business. If every bee in the yard were robbing, the air would be black with them; but this is usually not the case. It would be reasonable to suppose that a torch applied in the manner you describe around bees caught in the very act would soon destroy the actual culprits, finally bringing about peace and quiet in the yard. I should like to hear from our subscribers, whether anyone else has tried this or a similar plan.—Ed]

EXPLANATION OF PLATE.

Newly Introduced Cryptolæmus Ladybird.

(Cryptolæmus montrouzieri.)

Adult female beetle in centre.

Full grown larva in upper left hand corner.

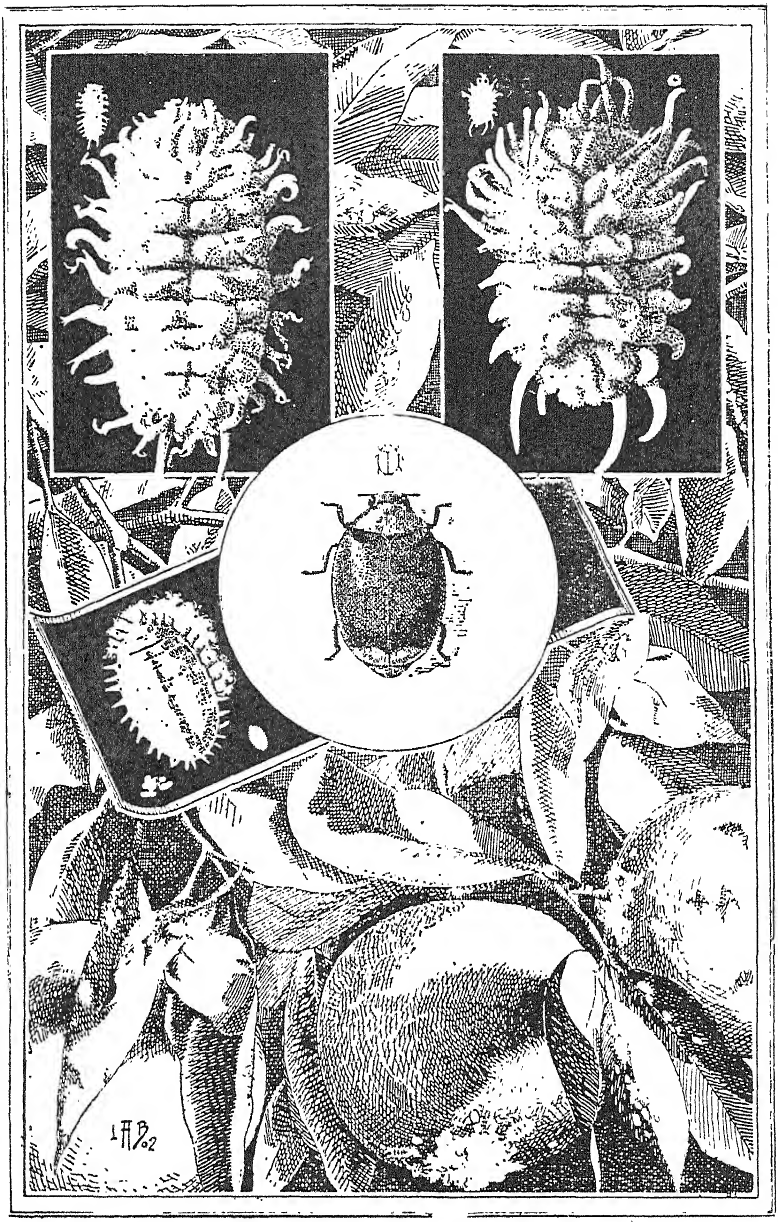
Pupa in upper right hand corner.

Adult mealy bug to left of beetle with its egg mass and a few eggs enlarged for comparison with the *Cryptolæmus* larva which it superficially resembles. The principal figures are all six times natural size. The small figures show the actual size.

Background orange foliage and fruit infested with mealy bug being preyed on by *Cryptolæmus*, half natural size. (Illustration taken from annual report of Government Entomologist of Cape of Good Hope.)

[*Cryptolæmus Montrouzieri.*—This valuable ladybird has become well established in this State, and since its introduction has rid the gardens in and around Perth of mealy bug, and is now found feeding upon the scale (*Eriococcus araucariæ*) which infests the Norfolk Island pine trees.

This *Cryptolæmus* beetle first attracted attention by its wonderful performance in ridding the Hawaiian Islands of various species of mealy bugs, which caused a great amount of damage annually to the vegetation of those islands.—Ed. *Journal.*]



Newly introduced Cryptolæmus Ladybird (*Cryptolæmus montrouzieri*).

INJURIOUS INSECTS AND THEIR PARASITES.

In the last issue of the *Journal* was published a letter from Mr. C. W. Woodworth, of Berley, California, dealing with the injurious insects of California and their treatment. In his letter Mr. Woodworth would have it believed that only artificial means had been used with any success. This statement was refuted by Mr. Compere, the Government Entomologist, who quoted certain reports issued by the California State Board of Horticulture on the subject. We now publish an article written by Dr. W. B. Wall, which appeared in a recent issue of the *California Fruit Grower*, entirely bearing out the statements made by Mr. Compere:—

"Possibly many of us have not given sufficient thought to the wonderful work and incalculable value of the parasites of injurious insects, many of them so small that they can scarcely be seen by the unaided eye; and yet they have done a work impossible to man. Without them, in a very few years, injurious insects would consume or destroy nearly all vegetation; so our very existence is largely dependent upon them. After their beneficial mission has been accomplished, they, in turn, would become an intolerable nuisance, but for their self limitation by the consuming of their own food supply. In this way Nature keeps up an equilibrium, except where man interferes with her plan by transplanting to a new field injurious insects to pursue their work of ruin, unrestrained by their natural parasites.

"This State Kind to All Life.

"It is needless to say that California is pre-eminently kind to all life, animal and vegetable, and that man has been drawn here from every quarter of the world. Either carelessly or ignorantly he has brought with him, or afterwards imported, many, if not all, the injurious insect pests with which we are afflicted. It matters not how they get here; when here, they live, multiply, and destroy. Horticulture in this State has been damaged many millions of dollars by the bringing in of pernicious insects without their parasites.

"The cottony cushion scale (*Iceria purchasi*) alone would ere this time have made California a barren waste if no parasite had been found to arrest its fearful ravages. It devoured all vegetation, except cone-bearing trees, and human effort was powerless to suppress it. The little Australian ladybird (*Vedalia cardinalis*) came to the rescue, and in an incredibly short time brought relief; this and many other beneficial insects have been introduced through the efforts of the State horticultural authorities.

"Some Scale Pests.

"There are other destructive scales we have been fighting for 20 years, with washes, sprays, fumigation, cutting off of tops, trunk scrubbing, etc., and have learned in the last few years to keep them fairly in check. In doing this, however, we have expended hundreds of thousands of dollars, and lost in quantity and quality of fruit and tree a vast sum of money; and the fight and expense still go on.

"Except the cottony cushion, the most destructive scale to citrus trees, and among the most difficult to kill, is the red (*Aspidiotus aurantii*). The yellow (*Aspidiotus citrinus*) and black (*Lecanium oleæ*) have also been a heavy tax on tree and purse. The deciduous trees, apricots, prunes, pears, etc., have their share of scales.

"With two exceptions, the codlin moth (*Corpocapsa pomonella*) and the purple scale (*Mytilaspis citricola*), there are, for all these hosts of harmful insects, legions of parasitic and predaceous ones to keep them restricted to comparatively harmless numbers.

"Now it is not so much whether we have or not parasites, as it is what they will accomplish. In order that we may have some idea as to what may reasonably be expected, we will refer to a few instances out of many as precedents for faith in their efficiency. Florida, about 1835 to 1840, believed her orange groves doomed to utter ruin, but they were rescued by a little chalcid fly. Australia had a like experience. In the early fifties, according to reliable report, the orange groves of California were being destroyed by the soft brown scale (*Lecanium hesperidum*); some trees were killed; others were following to the same fate. No fight was made by the grower except to cut off the tops and scrub the trunk of the tree, spraying or fumigation not having been introduced. In time the chalcid fly (*Coccophagus lecani*) put in appearance, freed the groves from the pest, and let them return to their former beauty and fruitfulness.

"The citrus groves of the San Gabriel Valley, for many years greatly damaged by the yellow scale, have been freed by the golden chalcid fly (*Aspidiopragus citrinus*), and now come reports from all along the coast of the disappearance of scales, especially of the black and San José, as the result of the work of parasites.

"Recent Investigations.

"In further evidence of the value of parasites, I will state conditions found through recent personal investigation. In a district south of the city of Los Angeles, a number of old groves, which were once badly infested with red and black scales, are now practically free from both, without having been sprayed or fumigated for a period of from three to five years; the pepper trees also in the vicinity are clean and bright.

"In the Santa Ana Valley of Orange County the same trees which for years were condemned and destroyed in large numbers

because of the prolific breeding of black scales upon them, are now free from scales, and instead of being an injury to our valley they have proved a benefit, inasmuch as they have served as a home and breeding place for several useful ladybirds (especially the *Rhizobius ventralis*, which is both parasitic and predaceous), they having found their way from these to citrus trees, where they are now in considerable numbers, except where they have been destroyed by recent fumigation or spray.

"After diligent search, I have been able to find only one small orchard and a solitary lime tree that have not been sprayed or fumigated within the past 18 months. These have not been treated for more than four years and are now free from all scale pests, the black scales having been destroyed by the ladybirds, and the reds evidently by the golden chalcid fly, which was brought into the valley some years ago from San Gabriel; but whose work had attracted no attention until August last, when, upon investigation, it was found in greater or less numbers over the entire valley. Where permitted, it is now doing a wonderful work, and but for having been held in check by annual fumigation or spray would have practically rid all orchards in the valley from the red scale. We have also the Chinese red scale parasite, which is undoubtedly a valuable one.

"In addition to the parasites mentioned, we have recently imported two for the black scale (the *Coccophagus flavo scutellum* and the *Scutellista cyania*), which have been pretty well distributed throughout the State by the horticultural quarantine officer and entomologist, Mr. Alexander Craw, who has rendered us such splendid service.

"We are now fighting the codlin moth and purple scale (*Mytilaspis citricola*) with artificial means, and it would be impossible to estimate the value of parasites for these pests. Recently I visited an orchard, which since August last, has been fumigated twice and sprayed once with distillate by the most approved method, and there are still enough live purple scales to thoroughly infest the trees within twelve months if no further treatment be resorted to. This scale, fortunately, spreads rather slowly, but is a persistent stayer when it makes lodgment. Mr. Craw informs me that the late Board of Horticulture has knowledge of the whereabouts of a parasite for the scale just mentioned, and is making efforts to have it introduced.

"OTHER DANGERS THREATEN.

"We should not allow ourselves to be led into a fancied security because we have learned in some measure to control the pests we already have, for there are many others with the importation of which we are daily threatened, either from other States of our Union or from foreign countries. I will mention only the white fly of Florida, the orange maggot of Mexico, and the melon maggot of

Honolulu, any one or all of which may be brought in any time by the almost daily communication by rail or steamer.

"To be properly safe-guarded, we should have a force of competent entomologists, backed by national, as well as State laws, continually on the outlook to prevent the introduction of all harmful insects, and to seek the world over, if need be, for their parasites.

"To do this will require a very small amount of money compared to the loss that must result from the introduction of even one of these pests, for instance, the orange maggot (*Trypeta ludens*), which is doing fearful mischief to the orange industry of some of the Mexican States.

"Should not these facts convince us that our best and most rational method of fighting insect pests is to procure and protect their natural enemies?"

In reference to the above Mr. John Isaac, of Sacramento, one of the best known horticultural writers in America, in an article appearing in the same issue of the paper as the foregoing, in speaking of insect pests, states:—"At present there are not over a half-dozen really serious pests of deciduous fruit trees, among which is the codlin moth, the woolly aphis, the peach root borer, and the various forms of aphids. For the latter the ladybirds are an efficient check." By this it will be noticed that as none of the scale insects are mentioned as being troublesome, it may be inferred that these are kept well under by parasites.

HOW TO KEEP MOSQUITOES FROM THE HOUSE.

The following rules for preventing the mosquito plague is taken from the United States *Bulletin*:—

1. Mosquitoes breed *only* in water; usually fresh, standing water in artificial places.

2. Mosquitoes occur in the vicinity in which they breed. Invasions from long distances are exceptional.

3. The young mosquito or "wriggler" lives in water at least 10 or 12 days.

4. Although the wrigglers live in water, they *must* come frequently to the surface to breathe.

5. Coal-oil on the surface of the water prevents the wriggler from breathing.

6. Destroy the breeding places and you will destroy the mosquitoes.

7. Empty the water from all tubs, buckets, cans, flower pots, vases, etc., once a week.

8. Fill in or drain all pools, ditches and various excavations, as post holes left unfilled, etc.

9. Change regularly every week all water needed in chicken-coops, kennels, etc.

10. Treat with coal-oil all standing water which cannot be screened or drained (1oz. of oil will cover 15 square feet of surface). The oil does not affect the water for use if the water is drawn from below.

11. Put wire netting over cisterns, wells and tanks of water in every-day use.

12. Places in which it is undesirable to place oil, such as watering troughs for stock, lily ponds, etc., can be kept free of the wrigglers by putting in gold fish. The nymphs of dragon flies and tadpoles of frogs also feed on the wrigglers.

13. See that the plumbing about the place is in perfect order. Prevent leakage of pipes or clogging of eaves.

14. Inspect all cesspools and see that the covers are *absolutely* tight.

15. Clean away all weeds, grass and bushes about ditches, ponds, and other possible breeding places, since these afford a hiding place for the adult mosquitoes.

16. Clean up vacant lots and back yards of all cans, tins, bottles and rubbish.

17. First do away with or treat all places where mosquitoes are known to breed, and then begin to work on places where they might breed.

18. As a citizen of your community you should feel a personal responsibility for the destruction of the mosquitoes in your district, and seek to co-operate with your neighbours in the work of doing away with breeding places. Inspect and treat with coal-oil gutters, culverts, ditches, man-holes, catch-basins, etc., along the roadside. Man-hole covers should be screened.

19. Where oil is applied to standing water it must be distributed evenly over the surface. Use a hand syringe, or, if the area is great, a knapsack sprayer.

20. Houses should be cleared of all winged mosquitoes by the burning of insect powder. The mosquitoes will fall to the floor, and should be collected and burned.

21. Relief in any community or district depends entirely upon the co-operation of the members of the community.

THE 1903 VINTAGE.

By W. and A. Gilbey.

[Reprinted from "The Times," 26th October, 1903].

On the Continent, as in England, every extreme of weather has been experienced this season. Not only the exceptionally late frosts (that of the 18th April was alone estimated to have reduced the value of the possible crop in France by something like 20 millions sterling), but hailstorms, excessive rains, and the resultant mildew have played havoc with the vines in almost every district. Added to this, spasmodic heats during the early summer—notably in Italy—have made up a sum of misfortunes which it is confidently asserted will, in the wine production of the four great wine-growing countries of Europe—France, Spain, Portugal and Italy—result in a deficit of no less than 40 million hectolitres, or say 880 million gallons, as compared with the yield of an average year.

It may interest your readers to have before them the figures showing the total production of wine during the past three years.

The World's Production of Wine.

—	1900.	1901.	1902.
Europe—	gallons.	gallons.	gallons.
France	1,482,000,000	1,275,197,308	877,443,226
Italy	583,000,000	937,200,000	748,000,000
Spain	517,000,000	433,400,000	365,200,000
Portugal	139,000,000	132,000,000	105,600,000
French possessions:— Algeria, Tunis, and Corsica	130,000,000	122,037,938	82,852,000
Madeira, Azores, and Canary Islands	7,000,000	6,600,000	3,256,000
Austria-Hungary	114,000,000	99,000,000	156,486,000
Germany	80,000,000	52,800,000	46,200,000
Other European countries: Russia, Switzerland, Turkey and Cyprus, Greece and Islands, Bulgaria, Servia, Roumania, Persia	351,700,000	325,600,000	244,200,000
North and South America	206,000,000	184,800,000	114,290,000
British Possessions—			
Australia	5,500,000	5,720,000	6,100,000
Cape of Good Hope ...	3,500,000	3,500,000	3,500,000
Total for World ...	3,618,700,000	3,577,855,246	2,753,127,226
Production in:—			
Europe	3,403,700,000	3,383,835,246	2,629,237,226
North and South America	206,000,000	184,800,000	114,290,000
British Colonies	9,000,000	9,220,000	9,600,000

Colonial Wines.

Australian Wines.—The wine production of the British Colonies has never had so much interest for British consumers as at the present time. Although, hitherto, there has been no resumption of shipments to the United Kingdom of wines from South Africa, which in 1859 amounted to no less than 781,581 gallons, but very shortly afterwards declined to vanishing point, importations from the Australian States have of late years shown a continually progressive increase, and it is confidently anticipated that the consumption of them in the United Kingdom will this year exceed a million gallons.

Cape Wines.—It must be borne in mind that in 1859 the wines of our Colonies paid only half duty as compared with foreign wines. All duties were, however, greatly reduced, as well as equalised, in 1860. The relative importance of our present Colonial wine trade will be more clearly recognised after reference to the following table of our home consumption of all varieties of wine in the years 1860, 1870 and last year:—

England's Consumption of Wine.

	1860.	1870.	1902.
	gallons.	gallons.	gallons.
French Wines	1,125,599	4,157,372	5,042,424
Portuguese Wines	1,776,138	2,947,028	3,695,972
Spanish Wines	2,975,769	6,269,325	3,813,717
German, Italian, Hugarian, etc. ...	1,479,735	1,758,432	1,800,129
Australian Wines	951	36,147	996,000
	7,358,192	15,168,304	15,348,242

It may almost be said that for Greater Britain, the Australian branch is the only bright spot in connection with the wine trade. With ten millions more population, and a larger proportional increase of wealth, it really appears incomprehensible that the entire consumption of wine at the present time in England should be only just over that of 1870, while it is feared that the current year will show less that 15 million gallons, or the smallest annual total for the past 33 years.

When it is remembered that this consumption is only equal to about two bottles of wine per head per annum of our population, against three bottles per head in 1870, and that the French people who are only separated from us by some 20 miles of sea, are to-day consuming no less than 180 bottles per head per annum, it will be seen what opportunities exist for a greatly increased consumption by the 42 million people of our nation, which at least may be reckoned as among the most opulent in the world.

Popularity of Australian Wines.

When Australian Wines were first brought prominently before the British public, their ready consumption was attributed in a great measure to the strong sentiment then growing up between the Mother Country and her States; but the ever-increasing sale of these wines clearly indicates that they possess a special merit of their own, which will ensure for them a permanent place in the wine commerce of our Empire.

Imperfect System of Duties.

An enquiry into the causes of the want of elasticity in the consumption of wine in the United Kingdom would, we doubt not, disclose the fact that it is largely due to our faulty system of levying the duties. Until some change is made in this respect, we cannot hope for any greatly increased consumption of wine, even though we should return to more industrially prosperous times, as the two present arbitary standards of duty—viz., 1s. 3d. per gallon on wines of all strengths under 30 degrees, and 3s. per gallon on wines of all strengths between 30 and 42 degrees—considerably neutralise the inducement to ship wines of the strengths which would show them in their highest state of perfection.

There is no doubt that the natural alcohol in wine, and particularly in moderate-priced wine, is one of its most valuable properties. Under our present system, a direct incentive exists to ship certain wines as strong as the limit of the duty will permit, apart from considerations of quality or suitability, the object being to obtain admittance under the lower or the higher scale of wine duty of as much alcohol as possible.

Taxing Wine by Alcoholic Strength.

If the question be thoroughly investigated, it will be found that there is only one true method of encouraging the shipment of wines of every country and every class at their best, and placing the wine trade upon a sound commercial basis, viz., by taxing wine according to the alcohol it contains, as is already the case with spirits and beer.

Some 25 years ago an effort was made to conclude a treaty with France on a basis, so far as her wines were concerned, of reducing the duty (of natural wines of low alcoholic strength) from one shilling to sixpence per gallon. Notwithstanding the strong advocacy of Mr. John Bright, the Government, advised by Sir Stafford Northcote (the then Chancellor of the Exchequer), did not give the proposal their support, and it was consequently rejected.

If the duty could now be readjusted,* so that the comparatively low-strengthed wines of Australia, France, and Germany were admitted at sixpence and ninepence per gallon, and that above 24

* Nearly all authorities on the question of alcoholic duties now recognise that the present irregular system of taxing wines requires readjustment, in the interest alike of consumer and the revenue.

degrees, we will say, all wines paid duty according to the alcohol, a new era might open for the wine trade generally, and each country's wine, unfettered by arbitrary imposts and artificial impediments and preferences, would stand far more on its own individual merits.

Comparative Strength of Wines.

From a Parliamentary paper that has recently been issued we learn that, during the year 1892, 3,535,341 gallons of wine were imported from Spain at an average strength of over 27 degrees proof spirit, whereas 987,203 gallons of Australian wine only averaged 22 degrees, or more than five degrees weaker than the Spanish wine. Both paid the same rate of duty—viz. 1s. 3d. per gallon—but in every hundred gallons of Spanish wine there were more than five gallons of proof spirit beyond the quantity of spirit in a hundred gallons of the Australian wine, which, according to the rate of duty on spirits, would have paid an additional duty of £2 15s. To put it in another way, each proof gallon of spirit contained in the Australian wine paid 5s. 8d. per gallon against 4s. 7d. only paid by the Spanish.

Colonial Wines Unfairly Taxed.

It is not our province here to enter into the question of a preferential tariff for wine produced in our colonies, but rather to point out that our present system of levying duties acts most unequally on the various countries of Europe, and, in addition, places the wines of our colonies at a great disadvantage as compared with those, for example, of Spain, Sicily and Madeira.

A Form of Hog Cholera not caused by the Hog-Cholera Bacillus.

Preliminary Remarks.

During the course of the investigations concerning hog cholera which have been carried on by the Biochemic Division of the Bureau of Animal Industry, certain outbreaks of that disease were met with which apparently were not produced by the hog-cholera or the swine-plague bacilli. The disease was highly contagious and fatal to a large proportion of the hogs which were attacked. These observations, which were inexplicable previous to the researches

herein recorded, together with the great variations in the physical symptoms and the *post mortem* lesions encountered in different outbreaks of so-called "hog cholera," have led us to institute experiments to determine, if possible, whether or not there are other infectious diseases among hogs in this country than those caused by the hog-cholera and swine-plague bacilli, and also to ascertain what was the etiological agent in those outbreaks of disease mentioned above, which apparently did not depend upon these bacilli for their existence. These experiments have not yet been completed, but have gone far enough to enable us to publish this preliminary note.

The outbreaks of disease which have furnished material for the study of the questions just outlined have all had their origin in South-Western Iowa, but, owing to the great distance of that point from Washington, and the fact that it was not possible to establish a satisfactory laboratory in the field, it has been found necessary to expose a certain number of animals to infection in Iowa and then transport them by express to the Bureau Experiment Station near this city, where all the inoculations were made by the superintendent of the station. After once bringing the disease to Washington no trouble was, as a rule, experienced in perpetuating it by transferring from one animal to another.

The experiments have reached such a stage that we feel justified in stating that there is an infectious disease among hogs in this country which cannot be distinguished clinically from hog cholera, and which may be reproduced by infecting with material which contains no hog-cholera bacilli. It will be understood that at this time no estimate can be made as to the frequency with which this disease occurs, nor as to its distribution throughout the country.

Below is presented a brief outline of the facts which have been established in regard to this disease.

Etiology.

Nothing can be stated at present as to the cause of this disease, although certain experiments, not yet complete, have given results of such a character that probably something more definite may be published in the near future in regard to the etiological factor in this form of hog cholera. It has been demonstrated, however, that the primary cause of this disease is neither the hog-cholera bacillus nor the swine-plague bacillus. We have transferred the disease repeatedly from one hog to another by subcutaneous inoculation of certain body fluids, these fluids being always proved, by careful bacteriological examinations, by filtration through the finest porcelain filters, and by the inoculation of guinea pigs and rabbits, to be free from hog-cholera and swine-plague bacilli. We have used a system of checks upon the various inoculation experiments by means of which we have been able to exclude all chance of accidental pen infection or of infection through the syringes.

The disease is highly contagious, healthy pigs that were allowed to come in contact with sick animals almost invariably becoming sick within the usual period of incubation. So far we have been unable to communicate this disease to any other animal than hogs. Rabbits and guinea pigs are entirely insusceptible to inoculations that are of sufficient size to destroy pigs weighing from 30 to 40 pounds.

Symptoms.

The period of incubation after exposure to sick animals, or after a subcutaneous inoculation of infectious material from sick animals, varies from five to twelve days, the usual time elapsing between exposure and visible signs of illness being seven days. The first symptoms noticed are that the pig is slightly indisposed; there is loss of appetite and listlessness, but as a rule nothing else on the first day. By the second day of visible illness the animal is usually very sick, hollow in flanks and has a staggering gait. There may or may not be diarrhœa, and the fæces are frequently blood-stained. Almost without exception the eyes are sore and the lids glued together. The symptoms just enumerated become gradually more pronounced until the death of the animal, which takes place as a rule within seven days after the appearance of the initial symptoms and approximately two weeks after the first exposure to infection.

It must be explained that the experimental pigs which we have used weighed from 15 to 40 pounds, and it is possible that in the case of older and larger animals the period of incubation and the course of the disease may be of longer duration. This point, together with many others, is left for future determination.

Post mortem Appearances.

The skin over the abdomen may be reddened throughout, or these cutaneous lesions may appear as more discrete purpuric areas of varying size. Upon removing the skin of the thorax and abdomen the subcutaneous areola tissue is generally found to be thickly dotted with small ecchymoses. There is usually not the slightest evidence of inflammation at the point of inoculation if the animal has been injected subcutaneously.

Lymphatic system.—The inguinal glands on both sides are reddened, as are the lumbar, retro-peritoneal, meso-colic, mesenteric, and bronchial glands. The reddening of these glands varies in intensity; at times the hemorrhagic condition is slight, while at others it is so intense that practically all of the glands are deep red, approaching black in colour.

Digestive system.—(*a*) *Stomach.* No lesions have been found in the stomach except small hemorrhages on its serous surface in

about 50 per cent. of the cases. (*b*) *The small intestines* usually present a large number of small ecchymoses on their serous surfaces, and not infrequently the mucous surface is in the same condition. (*c*) *Cecum and colon*. This portion of the intestines, almost without exception, shows hemorrhagic areas on its serous and mucous surfaces, these hemorrhages being much fewer in number and larger in extent than those seen in the small intestines. In the cecum and ascending colon it is not unusual to find large numbers of small newly formed ulcers which occasionally show a hemorrhagic centre. (*d*) In several instances there has been a most severe hemorrhagic inflammation of the *rectum* involving chiefly the serous surface and extending throughout its entire length. The intestinal contents are not infrequently blood-stained. (*e*) *Liver*. This organ is usually mottled, and exhibits numerous diffuse grayish areas which appear to be due to an increase of connective tissue. The histological examination of this organ is, however, not yet complete.

Lungs.—The lungs frequently show small petechiæ on their surface, but are very slightly affected compared with the other organs.

Heart.—Hemorrhagic areas are occasionally seen on the surface of the auricles and ventricles.

Spleen.—The spleen is always enlarged, dark in colour, and not infrequently shows small petechiæ on its under surface.

Kidneys.—The kidneys are always the seat of hemorrhagic changes, which vary in extent. At times the whole organ is intensely congested, with all the glomeruli being visible as minute, deep-red points, while at others it is as a whole not congested, but exhibits in its cortex a number of small, sharply defined, very dark hemorrhagic spots.

From the above-described lesions and symptoms it will be seen that this disease is apparently identical in all particulars with the acute type of hog cholera, and that it is produced without the aid of the hog-cholera bacillus.

The fact that this particular type of hemorrhagic hog cholera is so similar in both symptoms and lesions to the ordinary acute hog cholera supposed to be caused by the hog-cholera bacillus, and that, by our methods of inoculation, without the presence of the hog-cholera bacillus, but have never produced a case of *chronic* hog cholera, have led us to suspect that possibly in *all* outbreaks of *acute* hog cholera there is some other agent besides the hog-cholera bacillus at work, and that in those cases of acute disease where the hog-cholera bacillus is found we have to do, not with a pure infection, but with a mixed infection by hog-cholera bacilli and the organisms which are responsible for the disease which we have just described. In fact, virulent hog-cholera bacilli have been isolated from hogs in which the disease had been produced by inoculation

with infective material in which the absence of the bacilli had been proved by filtration, by cultures, and by the inoculation of rabbits or guinea pigs.

If such supposition is well founded it is quite evident what an important bearing it must have upon the prevention and treatment of hog cholera, and we hope to be able to decide this point positively when the experiments now under way have been completed.

Sufficient work has been done to show that this particular form of hog cholera may be prevented by those measures which have been found to be effective in dealing with the ordinary forms of that disease—the isolation of sick animals and disinfection of all infected lots with carbolic acid and lime being sufficient to prevent a spread of the disease.

The question of special methods of treatment has been taken up and will be reported upon later.

In this brief report our object has been simply to announce the existence of this infectious disease among hogs, and we have purposely avoided the presentation of details of experiments, which are reserved for publication in a more complete treatise on the subject.—[Circular issued by the United States Board of Agriculture.]

RINGWORM IN CATTLE.

Ringworm is a disease which may attack any of our domesticated animals, but is most frequently seen on cattle. It is also transmissible to human beings.

It evinces a decided preference for young animals, such as calves and yearlings, and for stock that are in poor condition.

The disease is due to the attack of a microscopic fungus *(Trichophyton tonsurans)* which establishes itself at the base of the hair, which in consequence becomes brittle and breaks off. The presence of the fungus also causes the epidermis of the skin to become thickened and wrinkled. In this way bare, grey, scaly patches, two inches or more in diameter appear upon the animal, especially on its head and neck, though also on other parts of its body.

As has been indicated, animals in low condition are most apt to be attacked, so that a preventative measure is to keep young stock in good condition.

The disease is not difficult to cure, the substances employed for this purpose being very varied. Many of them depend for their effectiveness on so smearing the affected patches that the fungus shall be smothered for want of air. In order to enable any substance employed to get thoroughly into contact with the disease, the part attacked should first be well washed with soft soap, or better still, with a solution of washing soda. Then the patch may be dressed with one or other of the following:—

(*a.*) Train oil, five parts; sulphur, one part.

(*b.*) Lard, five parts; sulphur, one part.

(*c.*) Lard, five parts; iodine, one part.

(*d.*) Lard, five parts; oleate of copper, one part.

(*e.*) Soft soap, five parts; sulphur, one part.

(*f.*) Sulphuric acid, one fluid drachm; glycerine, three fluid drachms.

Other substances employed, more or less successfully, are paraffin oil, lime made into a paste, and mercurial ointment.

The last-named, however, being highly poisonous, should only be used under the advice of a veterinary practitioner.

The disease is very contagious, and will linger on the woodwork of stalls, rubbing posts, etc., for many months. These should therefore be cleansed by a weak solution of carbolic acid, or by whitewash, or some other disinfecting agent.—Leaflet No. 95, Board of Agriculture, England.

DALGETY'S REPORT.

Messrs. Dalgety & Co., Ltd., report as follows in connection with their Perth and Fremantle markets for the week ending January 8th:—

Owing to the intervention of the Christmas holidays business has been somewhat dislocated, and is only now resuming its normal channels, the consequence being that the volume of transactions since our last report has been limited.

Chaff.—Supplies have shown a slight falling off, and the consequence is that a much firmer one prevails on our markets at rates which are on a parity with closing values in December. During the past week so much was the position felt that prime chaff advanced to £4 7s. 6d. per ton. Supplies were drawn from Pingelly, Northam, Seabrook, Moora, Grass Valley, Meckering, Waeel, Narrogin, Newcastle, Cuballing, Wongong, and Cunderdin. Of all the offerings, only a limited quantity consisted of really prime green wheaten, the bulk of the consignments being merely classed as

fair qualities. Farmers generally are not inclined to accept present rates, and for some little time at least supplies may come forward very slowly. The rates were as follows;—

AT PERTH.

Prime green wheaten ...	£4 to £4 2s. 6d. per ton.
Good quality from ...	£3 10s. to £3 15s. and £3 17s. 6d. per ton.
Other qualities from ...	£3 per ton.
Prime oaten from ...	£3 15s. to £3 17s. 6d. per ton.

At the above prices we sold at auction, since our last report, 101 trucks of produce. All lines of inferior chaff are meeting with better competition at the present time.

Pressed Straw.—Just at the present straw is in little demand.

Algerian Oats.—Fair business has been done in Algerians, and clean heavy milling was sold at 2s. 3½d. (free from other grain) whilst other qualities were sold at 2s. 1d. The market shows that there is a slightly improved demand for Algerians, and that the general tendency is firm During the week we cleared at auction and privately about 400 bags.

Barley, Malting.—This is meeting with good demand, and we affected. sales at 3s. 10s. per bushel.

Barley, Cape.—Business in this line during the past week has been quite at a standstill, no Cape Barley having come forward. The nominal value being from 2s. 6½d. to 2s. 8d. per bushel.

Hay, Baled.—We have to report a quiet week in this line, little business having been done. Values unaltered.

Wheat.—The markets in South Australia and Victoria are firm at recent quotations. With regard to local wheat, prices are practically unchanged since our last report, namely, on the basis of 3s. 3d. per bushel at Northam. On our local market a slightly firmer tone is noticeable, farmers showing greater disinclination to sell.

AT KALGOORLIE.

On Saturday the 2nd instant there was a heavy yarding, which accumulated through the holidays, but this has since been worked off, and subsequent arrivals have been very light. Although supplies were hardly sufficient for requirements there was not that active demand that might have been expected under the circumstances, but in a measure this was partly attributable to the indifferent qualities available. The closing rates were as follows:—

Prime green wheaten	£5 per ton.
Good quality, from	£4 10s. to £4 15s. per ton.
Other grains, upwards from ...	£4 per ton.

Hides and Skins.

Messrs. Dalgety & Co., Ltd., report having held a sale of hides and kangaroo skins on Friday, January 8th, when a large catalogue was submitted. Competition was animated, especially light-weight hides, which ruled ½d. per lb. higher. Heavies are still somewhat neglected, and prices were on a par with last year's closing rates.

Kangaroo skins sold readily at slightly improved values.

Hides—

Prime, stout, and heavy, 5½d. to 6d. per lb.
Medium heavy, 4½d. to 4¾d. per lb.
" light, 4½d. to 4¾d. per lb.
Prime heavy, 5d. to 5¼d. per lb.
" light, 4¾d. to 5d. per lb.
Extra light, 3½d to 4d. per lb.

Attention to flaying and preparation for market is most necessary, as all damaged lots rule fully ½d. to 1d. per lb. below quotations.

Kangaroo Skins—

Grey, fresh, ½lb., 1s. 3d. to 1s. 6d. per lb.
Grey, fresh, ¾lb. to 1½lb., 2s. to 2s. 4d. per lb.
Red, fresh, ¾lb. to 1½lb., 1s. 10d. to 2s. per lb.
Perished lots, 9d. to 1s. 3d. per lb.
Grey, fresh, 2lb., 1s. 7d. to 1s. 9d per lb.
Red, fresh, ½lb., 1s. to 1s. 3d. per lb.
„ „ 2lb., 1s. 3d. to 1s. 6d. per lb.
Wallaby, 1s. 3d. to 1s. 5d. per lb.
Extra light, to 8½d. per lb.

Euro, 1s. 2d. to 1s. 4d. per lb.

GARDEN NOTES FOR FEBRUARY.

By Percy G. Wicken.

In Western Australia, this month is about the warmest of the year, and, as we have had no rain for some two months, the soil in most places has become too dry to permit of very many vegetables being grown, except in low-lying and swampy places, or in such spots as a good supply of water from permanent sources is obtainable. Under these latter conditions a supply of vegetables can be kept up all the year round, but under ordinary conditions very little can be done in the vegetable garden except to try, by means of incessant cultivation, to keep alive such plants and flowers as may be growing. In small beds, where it is inconvenient to keep stirring the surface, the same result may be obtained by applying to the surface of the soil a mulch of well-rotted vegetable matter, which will have the effect of preventing the evaporation of the moisture from the surface, although at the same time it is likely to act as a harbour for insect pests. As soon as a plant has ceased to be profitable it should be either pulled up and thrown on the compost heap or else dug into the ground; no plant should be allowed to seed unless the seed is required for sowing or for sale. Apart from self-sown seed, from plants making the garden untidy and becoming weeds the following season, the act of forming seed does more to impoverish the soil than when the plant is cut down before the seeds form.

Noxious weeds, such as stinkwort and nut grass, will be seeding during this month, and steps should be taken to cut down all such pests before they have the opportunity to mature their seeds.

Beans (French).—If there is sufficient moisture in the soil to germinate the seed, a few more rows of these beans may be sown.

Beans (Madagascar).—These prolific climbers should now be in full-bearing, and the pods should be picked as young as possible, otherwise they become tough and fibry.

Beans (Lima) should now be in bearing. They are eaten the same as green peas; but, if in superabundant supply, they can be dried and kept until the winter, the same as haricot beans, and are equally as nice.

Beet (Red).—A further supply of seed may be sown. They require a rich soil, or land that has been well manured for the previous crop. They should be sewn in drills about 18 inches apart, and from 9 to 12 inches apart in the drills. Those already planted will require to be thinned out to this distance.

Beet (Silver).—A little more seed may be sown, and plants already up can be thinned out. The outside leaves of this plant should always be cut for use, leaving the inside leaves to mature for future cutting.

Brussels Sprouts.—These should do well in the cooler parts of the State. Plant and treat the same as cabbages.

Cabbage.—Make seed-beds, either in boxes or on the ground, so as to raise as many plants as you are likely to want to plant out this season. The soil in these beds should be very fine, and well mixed with fine well-rotted manure, so as to produce good healthy plants for planting out later on.

Carrots.—Prepare land by digging deeply and working up fine. Fresh manure should not be applied to this crop, but use land that has been manured the previous season. The seeds germinate slowly, and therefore the seed beds require to be kept free from weeds.

Cauliflower.—Make seed beds and plant out seeds same as for cabbages, and early plants will then be obtained, available for planting out at the first opportunity.

Melons.—All those melons and pumpkins required for seed should be allowed to become thoroughly ripe before cutting from the vine, and the seed when removed from the pulp should be thoroughly dried before being stored away.

Sweet Potatoes.—Some early ones may be ready for digging by the end of the month, but the main crop will not be ready until next month.

Potatoes.—Land should be prepared by being well worked and manured for sowing a crop of potatoes at the earliest opportunity in favourable localities; where there is sufficient moisture a crop may be obtained before the frosts come.

Tomatoes.—Destroy by burning or boiling all diseased fruit and tie up all plants to stakes to keep them off the ground.

Turnips.—Where sufficient moisture is present in the soil or can be supplied, a supply of this vegetable, of both white and swede varieties, should be planted; it is the early crop that generally pays best, and is also freest from aphis and other disease.

Farm.—Harvesting now being completed, the principal work on the farm will be chaff-cutting and threshing and carting the product of these operations to market. When cutting chaff, it will always be well to remove the string bands from the sheaves before putting through the machine. Cutting string bands with the sheaves has been done in many instances the last few years and has caused the death of several horses. Chaff in which string is found will generally bring a lower price than good quality chaff, and the loss is much greater than the value of the time taken to cut off the bands. Where the ground is of a light nature or sufficiently moist to enable ploughing to be carried out in a satisfactory manner, the work should be pushed on with as rapidly as possible, so as to have as large an area of land as possible ready to sow early in the season.

Unless the land is friable enough to enable the ploughing to be well done, it is better to leave it alone until the rain sets in; ground which is only scratched over and broken up at uneven depths, and in some places hardly touched, will never give satisfactory results, and accounts for many instances of the reported failure of crops which have been put down to summer ploughing.

Several instances of losses from bush fires have already occurred, and no doubt before these notes appear in print many others will be reported. The frequent reports of disaster from this cause should do more to impress on the minds of settlers the necessity of making firebreaks than the continual reference to the subject in these notes. It is often suggested that it should be made compulsory for all settlers to make firebreaks around their properties, to help to check these large bush fires.

THE CLIMATE OF WESTERN AUSTRALIA DURING DECEMBER, 1903.

The mean pressure for the month was below the average at almost every station. It was a distinctly cool month, except in West coastal districts. Throughout the Eastern goldfields the mean of the daily maximum was 8° to 10° below the average for previous years, and even in that region of intense heat, the Pilbarra Goldfields, although the mean was 99·9 at Nullagine and 103·3 at Marble Bar, yet these figures are considerably less than for previous years.

At this time of the year it is always interesting to compare temperatures at places where people are likely to spend their holidays. It will be noticed that the day temperature at Bunbury, Busselton, and Bridgetown is about the same as at Fremantle, but the nights vary greatly. Thus, whereas the mean minimum at Fremantle was 63·9, that for Bunbury was 56·0, Busselton 53·2, and Bridgetown 48·5. The rainfall was fairly normal on the whole, but considerably in excess of the average for previous years in the extreme North-East and throughout the Eastern goldfields.

A very heavy thunderstorm visited the Coolgardie district on the 16th, causing considerable damage, but there were no other disturbances specially worth chronicling.

As compared with the Eastern States, it will be seen that the mean maximum temperature in Perth was slightly in excess of that for Adelaide, and the nights were considerably warmer here, but it must be remembered that Adelaide enjoyed a particularly cool December, the day temperature being 3° below the average for previous years. Our days were on the whole 5·4° hotter than in Sydney, but our nights were 2·2° cooler. These again are not normal conditions, but on the average we are 2·3° hotter during the day and 2°9 cooler at night than Sydney. The figures for Melbourne have, unfortunately, not yet come to hand, but our average day temperature is 4° higher and our night 6·2° higher than in that city.

The Climate of Western Australia during December, 1903.

	Locality.	Barometer (corrected and reduced to sea-level).				Shade Temperatures.									Rainfall.	
						December, 1903.					*Average for previous Six Years.					
		Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Total Points since Jan. 1.
North-West and North Coast:	Wyndham ...	29·738	29·808	29·855	29·583	94·9	78·1	86·5	106·0	70·0	78·9	81·4	109·5	68·0	647	5325
	Derby	29·744	29·809	29·857	29·643	93·6	77·8	85·7	101·2	73·0	98·0	78·9	110·5	70·0	362	2550
	Broome ...	29·758	29·821	29·857	29·659	90·0	78·0	84·0	98·5	74·0	94·0	79·1	108·9	69·3	287	1905
	Condon ...	29·744	29·802	29·883	29·622	90·3	73·5	81·9	101·1	64·8	95·2	73·8	115·0	60·0	*Nil*	925
	Cossack ...	...	29·816	...	...	...	...	...	...	...	99·1	76·2	112·7	65·8	1	968
	Onslow ...	29·755	29·806	29·880	29·580	88·0	67·0	77·5	102·0	62·0	99·0	70·0	115·0	54·5	*Nil*	635
	Carnarvon ...	29·770	29·876	29·971	29·613	86·6	69·0	77·8	105·0	63·6	84·5	68·3	110·5	53·2	*Nil*	1234
	Hamelin Pool...	29·755	29·886	29·960	29·570	95·0	66·0	80·5	106·0	56·0	95·1	64·1	111·8	53·2	*Nil*	762
	Geraldton ...	29·835	29·949	30·090	29·610	84·0	63·0	73·5	104·0	50·0	80·5	61·2	110·0	50·0	*Nil*	2419
Inland:	Hall's Creek *	29·787	29·814	29·928	29·644	93·5	72·7	83·1	102·0	67·0	101·8	76·3	110·2	60·0	816	4102
	Marble Bar ...	...	...	...	...	103·2	74·6	88·9	112·0	65·2	...	...	...	...	173	829
	Nullagine * ...	29·690	29·758	29·876	29·556	99·9	72·2	86·0	107·5	59·0	105·0	73·3	113·0	60·1	197	863
	Peak Hill ...	29·720	29·796	29·910	29·430	95·0	70·0	82·5	105·0	54·0	99·6	73·4	109·7	57·0	17	561
	Wiluna ...	29·736	...	29·940	29·461	93·0	66·1	79·6	104·8	54·0	...	...	...	...	31	747
	Cue	29·765	29·830	29·920	29·460	96·0	66·0	81·0	105·0	53·0	98·7	69·0	112·0	50·5	31	596
	Yalgoo ...	29·782	29·856	29·968	29·493	92·2	63·5	77·8	106·0	53·5	96·6	64·4	113·5	49·8	*Nil*	708
	Lawlers ...	29·806	29·826	30·005	29·521	89·0	64·3	76·6	106·2	52·2	96·9	70·1	110·4	54·3	99	1015
	Laverton ...	29·844	...	30·088	29·477	86·6	61·8	74·2	105·0	50·1	...	...	...	...	27	861
	Menzies ...	29·867	29·856	30·088	29·559	84·5	60·7	72·6	101·0	49·2	94·1	66·0	109·4	50·2	167	1500
	Kanowna ...	...	...	...	...	82·6	57·2	69·9	101·8	48·2	...	...	...	...	155	1251
	Kalgoorlie ...	29·900	29·892	30·134	29·491	83·2	58·2	70·7	101·2	47·5	91·8	62·5	109·2	49·0	239	1223
	Coolgardie ...	29·834	29·888	30·155	29·491	82·8	56·4	69·6	101·8	48·9	91·8	61·0	110·2	47·8	148	978
	Southern Cross	29·865	29·881	30·090	29·510	87·0	58·0	72·5	103·0	47·0	92·5	60·4	111·3	47·4	60	902
	Walebing ...	...	...	...	...	86·3	58·1	72·2	101·2	48·2	...	...	...	...	6	2162
	Northam ...	...	...	...	...	89·5	60·2	74·8	103·0	46·0	...	...	...	...	9	1778
	York	29·890	29·942	30·140	29·590	90·0	59·0	74·5	102·0	50·0	88·8	57·5	114·5	47·0	6	1660
	Guildford ...	...	...	...	...	85·2	60·0	72·6	100·0	47·0	...	...	...	...	27	2683

* For the first time means of previous years are taken between 1897 (when the Meteorological Service was re-organised) and 1902 (inclusive). All observations prior to 1897 have been rejected, except in the case of the Perth Botanical Gardens.

The Climate of Western Australia during December, 1903—*continue* .

Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Shade Temperatures. December, 1903. Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	*Average for previous Six Years. Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Total Points since Jan. 1
South-West and South Coast:															
Perth Gardens ...	29·902	29·964	30·119	29·575	84·0	60·8	72·4	97·6	46·2	83·3	60·3	114·0	47·0	55	3545
Perth Observatory	29·909	29·978	30·117	29·562	81·4	60·8	71·1	95·3	49·6	79·4	59·9	102·1	49·2	63	3569
Fremantle ...	29·922	29·983	30·142	29·712	78·6	63·9	71·2	95·8	55·8	75·8	61·4	104·0	51·5	25	3302
Rottnest ...	29·914	29·957	30·113	29·630	76·4	61·5	69·0	93·0	50·2	74·1	61·5	102·0	51·0	16	2899
Mandurah ...	...	...	...	...	82·2	59·1	70·6	96·1	44·1	...	...	...	...	40	3646
Wandering ...	...	...	...	...	...	...	...	...	...	...	...	...	...	173	2904
Collie	...	...	...	...	82·0	51·7	66·8	95·5	39·4	...	...	...	...	74	3806
Donnybrook ...	...	...	...	...	79·8	54·4	67·1	93·8	39·8	...	...	...	...	58	3762
Bunbury ...	29·945	29·997	30·140	29·620	79·0	56·0	67·5	91·0	46·0	77·8	55·6	101·5	44·4	129	4457
Busselton ...	...	...	...	...	79·2	53·2	66·2	88·5	40·0	...	...	...	...	60	3089
Bridgetown ...	...	...	...	...	79·9	48·5	64·2	94·4	37·0	...	...	...	...	57	3698
Karridale ...	29·932	30·010	30·142	29·622	74·0	55·0	64·5	90·0	45·0	73·4	54·3	101·0	43·0	146	4134
Cape Leeuwin ...	29·930	29·980	30·160	29·470	71·0	60·0	65·5	81·0	56·0	71·3	59·9	98·4	53·0	118	2918
Katanning ...	29·931	29·952	30·186	29·572	80·0	53·0	66·5	96·0	43·0	83·8	53·0	105·8	41·0	119	2431
Albany	29·984	29·990	30·211	29·604	70·9	55·1	63·0	87·8	43·5	71·6	54·7	103·0	41·2	123	4044
Breaksea... ...	29·805	29·989	30·230	29·630	67·0	58·0	62·5	82·0	51 0	68·2	57·2	94·0	46·0	253	3262
Esperance ...	...	29·980	...	...	74·0	55·0	64·5	93·0	40·0	76·8	57·2	108·0	40·8	138	2497
Balladonia ...	29·960	...	30·195	29·559	80·0	51·8	65·9	101·7	42·2	...	...	...	...	82	905
Eyre*	29·951	29·963	30·270	29·628	72·0	56·3	64·2	102·0	42·0	78·4	56·9	112·2	38·2	229	1322
INTER-STATE.															
Perth	29·909	29·978	30·117	29·562	81·4	60·8	71·1	95·3	49·6	79·1	59·9	102·1	49·2	63	3569
Adelaide	29·919	29·946	30·282	29·500	80·8	57·9	69·4	99·7	46·9	83·6	59·1	114·2	43·0	116	...
Melbourne	...	29·820	...	...	...	...	...	...	...	75·4	53·7	110·7	40·0	...	...
Sydney	29·910	29·918	30·150	29·520	76 0	63·0	69·5	87·0	58·0	77·1	62·8	104·1	49·3	393	3862

* For the first time means of previous years are taken between 1897 (when the Meteorological Service was re-organised) and 1902 (inclusive). All observations prior to 1897 have been rejected, except in the case of the Perth Botanical Gardens.

The Observatory, Perth,
January, 1904.

W. E. COOKE,
Government Astronomer.

RAINFALL for November, 1903 (completed as far as possible), and for December, 1903 (principally from Telegraphic Reports).

Stations.	November.		December.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
East Kimberley:				
Wyndham ...	121	8	647	17
6-Mile	162	8	965	15
The Stud Station	...	...	...	...
Carlton	132	4	...	...
Denham	1090	5	...	...
Rosewood Downs	...	...	...	...
Argyle Downs ...	239	12	...	...
Lisadell	...	...	...	...
Turkey Creek ...	318	9	974	...
Plympton, St. Mary	...	...	...	...
Koojubrin ...	...	...	...	...
Hall's Creek ...	224	7	816	...
Flora Valley ...	...	...	...	...
Ruby Plains ...	...	...	...	...
Denison Downs...	...	...	...	...
West Kimberley:				
Obagama ...	...	...	...	...
Beagle Bay ...	...	...	...	...
Derby	Nil	...	362	12
Yeeda	Nil	...	...	...
Liveringa ...	...	...	...	...
Mt. Anderson ...	...	...	...	...
Leopold Downs...	...	...	...	...
Fitzroy Crossing	Nil	...	1209	14
Fitzroy (C. Blythe)	...	...	...	...
Quanbun ...	...	...	...	...
Nookanbah ...	...	...	...	...
Broome	Nil	...	297	7
Roebuck Downs	...	...	...	...
Thangoo... ...	...	...	...	...
La Grange Bay...	Nil	...	76	3
North-West:				
Wallal	Nil	...	Nil	...
Condon	Nil	...	Nil	...
DeGrey River ...	Nil	...	...	...
Port Hedland ...	Nil	...	9	2
Boodarie ...	Nil	...	...	...
Warralong ...	Nil	...	...	...
Muccan	Nil	...	...	...
Ettrick	Nil	...	...	...
Mulgie	Nil	...	...	...
Eel Creek ...	...	...	...	...
Pilbarra	Nil	...	147	2

Stations.	November.		December.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
North-West—*cont.*				
Coongon... ...	...	...	...	...
Warrawagine ...	...	...	...	...
Bamboo Creek ...	Nil	...	58	2
Marble Bar ...	Nil	...	173	7
Warrawoona ...	Nil	...	52	2
Corunna Downs...	Nil	...	...	...
Nullagine ...	Nil	...	197	5
Yandicoogina ...	...	...	...	...
Kerdiadary ...	...	...	...	...
Roy Hill... ...	Nil	...	...	...
Mosquito Creek	...	...	...	...
Mulga Downs ...	...	...	...	...
Woodstock ...	...	...	...	...
Mt. Florence ...	...	...	...	...
Tambrey ...	...	...	...	...
Millstream ...	Nil	...	...	...
Yandyarra ...	...	...	...	...
Mallina	...	...	...	...
Whim Creek ...	Nil	...	22	1
Cooyapooya ...	...	...	...	...
Woodbrooke ...	Nil	...	...	...
Croydon	Nil	...	...	...
Balla Balla ...	Nil	...	Nil	...
Roebourne ...	Nil	...	Nil	...
Cossack	Nil	...	1	1
Fortescue ...	Nil	...	Nil	...
Mardie	Nil	...	...	...
Mt. Stewart ...	Nil	...	...	...
Yarraloola ...	...	...	...	...
Chinginarra ...	Nil	..	...	...
Onslow	Nil	...	Nil	...
Peedamullah ...	Nil	...	...	...
Red Hill	Nil	...	...	...
Mt. Mortimer ...	Nil	...	...	...
Peake Station ...	...	...	...	...
Nanutarra ...	Nil	...	...	...
Yanrey	Nil	...	...	...
Point Cloates ...	Nil	...	...	...
Gascoyne:				
Winning Pool ...	Nil	...	172	1
Towara	Nil	...	...	...
Ullawarra ...	...	...	...	...
Maroonah ...	...	...	...	...
Gifford Creek ...	...	...	...	...
Bangemall ...	...	...	...	...
Mt. Augustus ...	...	...	...	...

RAINFALL—*continued.*

Stations.	November. No. of points. 100 = 1in.	November. No. of wet days.	December. No. of points. 100 = 1in.	December. No. of wet days.
Gascoyne—*contd.*				
Minnie Creek ..	Nil	...	...	...
Yanyeareddy ...	Nil	...	...	...
Williambury ...	Nil	...	...	...
Wandagee ..	...	...	...	...
Boolathana ...	Nil	...	...	...
Carnarvon ...	Nil	...	Nil	...
Brick House ...	Nil	...	...	...
Mungarra ...	Nil	...	...	...
Dairy Creek ...	Nil	...	...	...
Dirk Hartog Is'nd	Nil	...	...	...
Sharks Bay ...	Nil	...	44	1
Kararang ...	...	...	...	...
Meedo	2	1	...	...
Tamala	Nil	...	...	...
Wooramel ...	4	1	69	1
Hamelin Pool ...	1	1	Nil	...
Berringarra ...	Nil	...	...	...
Mt. Gould ...	Nil	...	...	...
Moorarie ...	Nil	...	...	...
Wandary... ...	Nil	...	...	...
Peak Hill ...	20	1	17	1
Horseshoe ...	10	1	...	...
Mt. Frazer ...	...	...	...	...
Abbotts	25	1	Nil	...
Belele	...	...	...	...
Mileura	Nil	...	...	...
Milly Milly ...	Nil	...	8	1
Manfred ...	Nil	..	Nil	...
New Forest ...	Nil	...	...	...
Woogorong ...	Nil	...	Nil	...
Boolardy... ...	...	..	...	...
Twin Peaks ...	Nil	...	...	...
Billabalong ...	...	...	Nil	...
Wooleane ...	Nil	...	...	...
Meeka	...	...	30	1
Mt. Wittenoom ...	Nil	...	35	1
Nannine	Nil	...	38	3
Star of the East...	Nil	...	40	3
Annean	8	1	59	4
Coodardy ...	Nil	...	26	3
Cue	Nil	...	31	4
Day Dawn ...	Nil	...	32	2
Lake Austin ...	Nil	...	30	3
Lennonville ...	Nil	...	49	3
Mt. Magnet ...	Nil	...	48	3
Challa	...	...	82	3
Youeragabbie ...	Nil	...	79	2
Murrum	Nil	...	...	...

Stations.	November. No. of points. 100 = 1in.	November. No. of wet days.	December. No. of points. 100 = 1in.	December. No. of wet days.
Gascoyne—*contd.*				
Burnerbinmah ...	1	1	...	...
Mellinbye ...	41	1	...	...
Barnong... ...	Nil	...	22	1
Yalgoo	Nil	...	8	1
Wagga Wagga ...	Nil	...	20	3
Gabyon	9	1	...	...
Gullewa	Nil	...	12	1
South-West Division (Northern Part):				
Murchison House	Nil	...	...	...
Mount View ...	Nil	...	...	...
Mumby	...	...	16	1
Yuin	...	...	..	...
Northampton ...	Nil	...	Nil	...
Mt. Erin ...	...	...	...	...
Oakabella ...	...	...	...	...
Narra Tarra ...	...	...	...	...
Tibradden ...	3	1	33	2
Sand Springs ...	66	1	...	...
Mullewa... ...	14	1	66	4
Kockatea ...	8	1	...	...
Bootenal ...	...	...	...	...
Geraldton ...	45	4	Nil	...
Greenough ...	59	1	Nil	...
Dongara ...	35	1	6	1
Dongara (Pearse)	37	1	...	...
Mingenew ...	142	3	36	6
Urella	92	1	42	2
Yandenooka ...	...	...	...	...
Rothesay ...	66	1	...	...
Field's Find ...	20	1	...	...
Carnamah ...	44	2	43	2
Watheroo ...	18	3	21	2
Dandaragan ...	12	1	Nil	...
Moora	20	1	2	2
Yatheroo ...	Nil	...	...	...
Walebing ...	6	2	6	2
New Norcia ...	18	3	15	1
South-Western Division, Central (Coastal):				
Gingin	28	3	12	1
Belvoir	54	3	11	3
Mundaring ...	80	5	33	3
Guildford ...	132	4	27	3

RAINFALL—*continued.*

Stations.	November. No. of points. 100 = 1in.	November. No. of wet days.	December. No. of points. 100 = 1in.	December. No. of wet days.	Stations.	November. No. of points. 100 = 1in.	November. No. of wet days.	December. No. of points. 100 = 1in.	December. No. of wet days.
South-Western—*continued.*					South-West—*contd.*				
Kalbyamba ...	120	1	45	4	Gillimaning ...	Nil	...	...	...
Canning W't'r'w'ks	105	2	...	...	Bunking ...	30	2	...	...
Perth Gardens ...	104	5	55	5	Bullock Hills ...	13	2	...	...
Perth Observatory	130	7	63	7	South-West Division (Southern Part):				
Subiaco	110	4	58	6					
Claremont ...	...	...	...	...					
Fremantle ...	110	3	25	5	Bunbury ...	42	3	129	6
Rottnest	133	7	16	4	Collie	43	7	74	7
Armadale ...	90	2	...	...	Glen Mervyn ...	78	6	...	...
Rockingham ...	52	3	131	6	Dardanup ...	11	2	...	...
Canning River ...	118	4	34	4	Donnybrook ...	25	5	58	3
Jarrahdale ...	46	2	87	4	Boyanup ...	28	5	110	7
Mandurah ...	3	1	...	...	Ferndale ...	81	6	...	...
Pinjarra	20	4	67	5	Busselton ...	10	4	60	4
Yarloop	15	3	...	...	Quindalup ...	13	6	72	6
Harvey	20	3	...	...	Cape Naturaliste	44	8	...	...
					Lower Blackwood	70	5	140	5
South-West, Central Part (Inland):					Karridale ...	106	13	146	9
					Cape Leeuwin ...	86	9	118	10
					Biddellia ...	176	9	95	4
Hatherley ...	...	...	...	...	The Warren ...	231	9	116	6
Momberkine ...	62	5	17	2	Lake Muir ...	120	8	...	...
Monglin ...	50	1	...	...	The Peninsula ...	80	11	...	...
Newcastle ...	13	2	Nil	...	Mordalup ...	95	8	...	...
Eumalga ...	28	4	2	1	Deeside	127	7	...	...
Northam ...	37	3	9	1	Riverside ...	134	9	...	...
Grass Valley ...	34	1	56	1	Balbarup ...	147	7	...	...
Meckering ...	23	1	4	3	Wilgarup ...	102	10	...	...
Cunderdin ...	26	1	...	...	Mandalup ...	...	...	...	...
Codg-Codgin ...	11	2	...	...	Bridgetown ...	65	9	57	6
Yarragin ...	18	3	...	...	Westbourne ...	116	13	...	...
Doongin	18	1	20	1	Hilton	38	3	...	...
Cuttening ...	38	1	20	3	Greenbushes ...	34	3	74	4
Whitehaven ...	43	1	...	...	Greenfields ...	45	6	...	...
Sunset Hills ...	37	1	...	...	Glenorchy ...	78	6	...	...
Cobham	50	2	5	2	Williams ...	18	7	105	7
York	57	2	6	2	Arthur	26	4	48	5
Beverley ...	36	2	9	2	Darkan	35	3	...	...
Barrington ...	42	1	29	3	Wagin	37	5	58	3
Stock Hill ...	7	1	88	2	Glencove ...	55	4	121	6
Sunning Hill ...	8	2	...	...	Dyliabing ...	50	6	134	6
Wandering ...	20	4	173	3	Katanning ...	16	3	119	6
Glen Ern ...	11	4	125	6	Kojonup ...	66	8	105	5
Pingelly ...	25	2	122	3	Broomehill ...	184	6	190	7
Marradong ...	18	1	93	4	Sunnyside ...	20	2	...	...
Bannister ...	104	7	...	...	Woodyarrup ...	49	5	...	...
Narrogin ...	14	3	92	7	Cranbrook ...	...	...	...	...
Wickepin ...	3	1	...	...	Blackwattle ...	124	7	...	...

RAINFALL—*continued.*

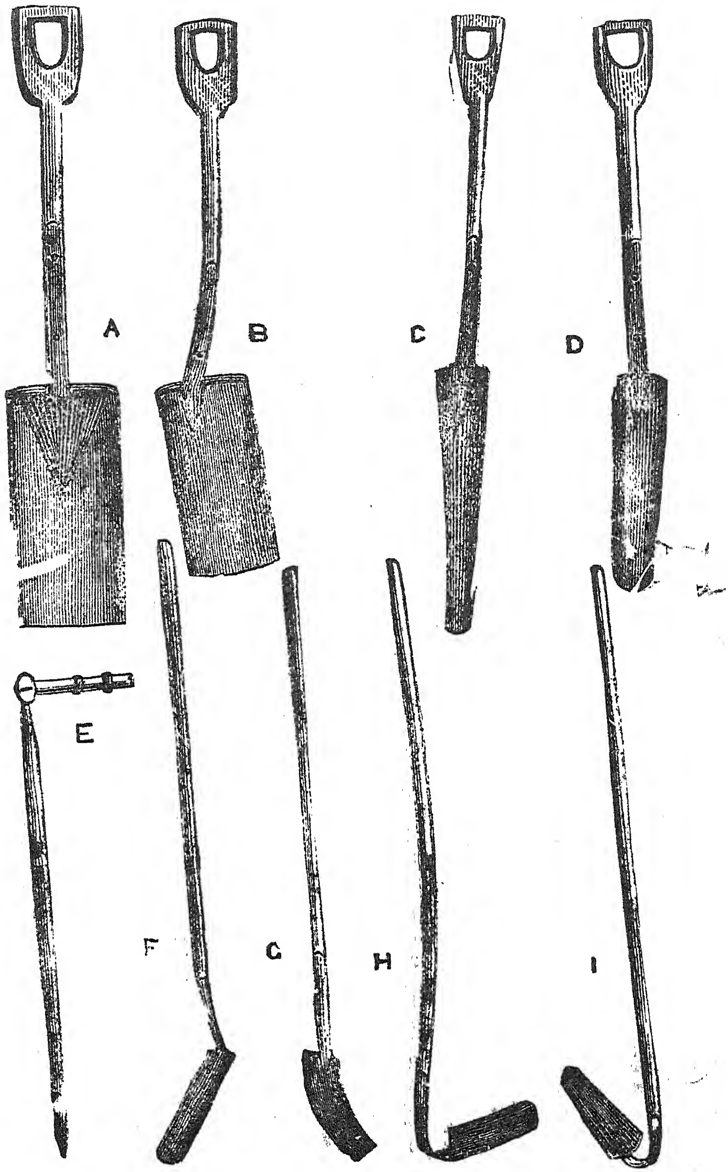
Stations.	November. No. of points. 100 = 1in.	November. No. of wet days.	December. No. of points. 100 = 1in.	December. No. of wet days.
South-West—*con.*				
Wongenellup	118	10	...	...
Mt. Barker	219	14	152	9
Kendenup	149	9	82	4
St. Werburgh's	208	14	...	...
Forest Hill	241	12	...	...
Grassmere	177	15	119	10
Albany	170	12	123	9
King River	177	7	109	5
Point King	80	6	158	6
Breaksea	183	12	253	12
Wattle Hill	461	15	...	...
Cape Riche	177	8	...	...
Pallinup	62	6	...	...
Bremer Bay	158	7	135	7
Jarramongup	212	10	...	...
Eastern Division:				
Dural	Nil	...	...	...
Lake Way	Nil	...	31	4
Gum Creek	Nil	...	...	...
Mt. Sir Samuel	Nil	...	90	3
Lawlers	11	3	99	7
Leinster G.M.	Nil	...	...	...
Lake Darlôt	...	...	...	...
Mt. Leonora	6	1	49	5
Mt. Malcolm	8	1	163	...
Mt. Morgan	15	1	28	2
Burtville	...	...	72	1
Laverton	Nil	...	27	3
Murrin Murrin	3	1	132	6
The Granites	30	1	120	5
Tampa	39	1	...	...
Kookynie	13	2	182	8
Niagara	9	2	135	5
Yerilla	Nil	...	237	4
Edjudina	6	2	...	...
Menzies	3	1	167	8
Mulline	10	1	150	6
Waverley	15	2	191	5
Goongarrie	11	2	238	7
Mulwarrie	Nil	...	112	5
Bardoc	Nil	...	162	4
Kurawa	17	2	220	6
Kurnalpi	23	3	162	6
Bulong	47	3	133	5
Kanowna	38	3	155	6

Stations.	November. No. of points. 100 = 1in.	November. No. of wet days.	December. No. of points. 100 = 1in.	December. No. of wet days.
Eastern—*contd.*				
Kalgoorlie	11	2	129	5
Coolgardie	15	4	148	4
Burbanks P.O.	22	3	191	5
Woolubar	45	4	183	7
Widgiemooltha	53	3	162	7
50-Mile Tank	...	...	72	4
Waterdale	36	4	...	...
Norseman	90	3	151	...
Lake View	90	3	...	...
Bulla Bulling	6	1	248	5
Woolgangie	41	4	...	...
Boondie	56	4	54	5
Boorabbin	46	4	30	3
Koorarawalyee	54	4	54	5
Karalee	20	2	70	4
Yellowdine	84	4	107	7
Southern Cross	53	4	60	4
Parker's Range	...	...	127	7
Parker's Road	82	4	49	2
Mt. Jackson	70	1	81	5
Bodallin	55	2	...	...
Burracoppin	19	...	...	...
Kellerberrin	26	1	21	2
Merredin	28	3	13	3
Wattoning	64	2	...	...
Eucla Division:				
Ravensthorpe	95	7	173	6
Coconarup	46	8	...	...
Hopetoun	147	7	218	10
Fanny's Cove	57	1	...	...
Park Farm	52	6	208	6
Esperance	29	6	138	7
Gibson's Soak	67	5	...	...
30-Mile Condenser	66	4	...	...
Swan Lagoon	41	7	...	...
Grass Patch	56	5	...	...
Myrup	77	7	171	6
Lynburn	67	5	141	6
Boyatup	81	5	...	...
Point Malcolm	128	8	...	...
Israelite Bay	29	6	137	7
Balladonia	11	2	82	9
Eyre	6	2	229	8
Mundrabillia	Nil	...	...	...
Eucla	2	1	132	6

The Observatory, Perth,
6th January, 1904.

W. E. COOKE,
Government Astronomer.

By Authority: Wm. Alfred Watson, Government Printer, Perth.



Tools used for drain making.

JOURNAL

OF THE

Department of Agriculture

OF

WESTERN AUSTRALIA.

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NOTES.

LANDS OPEN FOR SELECTION.—Elsewhere in this issue will be found a notice from the Lands Department, informing the public that 800,000 acres of land suitable for mixed farming on the route of the proposed Collie-Narrogin railway.

POULTRY FOR SALE.—The Director of Agriculture has decided to sell off all surplus poultry, ducks, geese, and turkeys, reared at the Experimental Farm, Narrogin. The poultry and ducks will be sold for ten shillings and seven shillings and sixpence each; geese and turkeys, a pound each.

TRIAL SHIPMENT OF GRAPES.—In the last issue of the *Journal* a report appeared dealing with the matter of a trial shipment of grapes to England, in which Mr. Despeissis is made to say: "That he had brought back with him from Europe some vines of the 'Colorado' grape, which is, so far as known at present, the *best* grape grown for export purposes." This should have read: "That the 'Colorado' grape was one of the best grown for export purposes." The best, so far as is known at present, being the "Almeria."

DISEASES OF THE HORSE.—We have received a book on "The Diseases of the Horse." It is a report made by Drs. Pearson, Michener, Law, Harvaugh, Trumbower, Liantard, Holcombe, Hindekoper, Stiles, and Adams to the Bureau of Animal Industry of the United States of America. The book, which contains some

600 pages, is full of most useful and valuable information. The gentlemen making the report are all specialists and all veterinarians eminent in their profession. The book has been placed in the library of the Department of Agriculture, and may be consulted by the public during office hours.

A Plum Without a Stone.—*American Gardener* says that a short time ago he received from Luther Burbank specimens of his new stoneless plum, "Miracle." He tells us that the tree is a good grower, an enormous bearer, and in every way satisfactory, and Mr. Burbank has a soundly established reputation for stating facts, so we accept the statement as to the tree. Its plum has a deep purple skin, flesh firm. The pit is reduced to a few shells or chips of shell, and the kernel stands naked on cutting the fruit. The flavour is all right, and for culinary purposes we fancy the advantage of having a plum and its rich kernel flavour without the hard shell will be great.

Annual Conference of Producers.—The Hon. the Minister for Lands, with the advice of the Advisory Board, has directed that it would be better and more in the interest of new settlers that the annual Conference of Producers should not be held this year. It is also suggested that societies be asked to arrange for one of their delegates to read a paper at the next Conference (in 1905) on some matter of general interest. Papers by the scientific and expert officers of the Department will also be read and afterwards discussed. It is hoped that this change in the general proceedings will induce those delegates attending the Conference to take a greater interest in the meetings. Further particulars will be published later on.

Whitewashing Fruit Trees.—The old-time method of whitewashing the trunks of fruit trees, says *Meehan's Monthly*, is not usually credited with its full value. Farmers follow it considerably, though perhaps more from a country habit than with definite reason before them. Professor M. T. Macoun, horticulturist for the Canadian Department of Agriculture, adds that it is most efficient when composed of 60 pounds of lime, 24 gallons of water, and six gallons of skim milk, or those proportions. The milk makes the wash stick better, giving the lime more opportunity to exercise its caustic properties. A little glue is sometimes substituted for the skim milk, with same results.

Experimental Farm Crops.—The field officer, Mr. Wicken, has furnished the Director of Agriculture with an estimated return of the crops now being harvested at the Experimental Farm, Narrogin, from which we take the following:—Seed wheats: Medick, 25 bushels; White Lammas, 20 bushels; Australian

Talavera, 30 bushels; Baroota Wonder, 70 bushels; Jade, 30 bushels; Australian Crossbred, 76–20 bushels; Australian Crossbred, 172–60 bushels; rye, 8 bushels; early ripe oats, 10 bushels; and Chinese Hullen oats, 6 bushels. There will also be about 80 bushels of chicken wheat and 25 tons of hay and straw. The approximate yield of the whole of the grain crops are:—Grain, 10 bushels per acre; hay, 10cwt. per acre. The very late and wet season being very detrimental to the best results being obtained.

THE NEW POULTRY MOVEMENT.—The work of the Utility Poultry Club is not generally known to the farming community, but an article on the subject in *World's Work* gives a very interesting *résumé* of it. There are two kinds of poultry, utility and show poultry, or in other words, the useful and the useless, and this club has been instituted to develop the laying properties of the hens, and roosting properties of the cockerels of the former class. Fanciers have been splitting hairs—or rather feathers—so much that there are now four kinds of Orpingtons, six of Leghorns, and eight of Wyandottes, while every year sees the bringing out of some fresh "breed." The Utility Club instituted egg-laying competitions as far back as 1897, and during the six years intervening it is instructive to note the results obtained each year in a sixteen weeks' contest during the winter time. The prize-winning pen of hens in 1898 laid 161 eggs, while in 1903 the prize winners laid 276—there being a very large increase all round. A tremendous variation was found between hens of the same pen which looked alike; of two hens out of the same brood one gave 67 eggs and the other only nine. Some hens never laid an egg at all during the whole sixteen weeks, and some only three to ten. One white Wyandotte gave 78 eggs, another only 47, and so on. It was found that no one breed was better than others—all kinds winning in turn—but that the strain or family counted for much. The moral of the trial is that if eggs from good layers only were hatched out, then the average or total yield of eggs would be greatly increased. The difficulty is to find out which are the best layers. In the above trials the laying boxes were so constructed that when a hen entered she shut herself in, and could not get out till she cackled and brought the hen man to let her out. The ordinary farmer is not adapted either mentally or physically for work of this sort. The writer has spent many half-crowns and even whole crowns for settings in by-gone years, but he has never yet come across a hen that will lay when eggs are six for a shilling, or that will hatch out 12 to the dozen.—*Exchange.*

AGRICULTURE AND VITICULTURE IN EUROPE.

(Report by Mr. A. Despeissis.)

The following very interesting report on the late travels of Mr. Despeissis, the State Horticultural and Viticultural Expert, has been presented to the Hon. the Minister for Lands :—

Mineral Phosphates.

On the 18th June I left Fremantle for Marseilles, and towards the end of July I visited some of the most important phosphate deposits at present exploited in Europe, in the neighbourhood of Abbeville, in Normandy.

Whilst there I gained much valuable information, which will, I trust, be useful when, as I have no doubt, we discover workable phosphatic formations in Western Australia. Anything under 30 per cent. of phosphate of lime is not deemed payable; the richness reaches 75 per cent., and even more.

The phosphate, when dried and sifted, sells wholesale at 6d. to 10d. per unit from the lower grade up (£1 to £3 per ton).

So skilled are the men employed in the field at locating the deposits, that when uncovering them they know to an inch where the earth ends and where the phosphates commence.

Later on, towards the end of August, while waiting for the beginning of vintage, I visited Tocqueville, near Setif, in the province of Constantine, in Algeria, where another important phosphate formation occurs, which in appearance is quite unlike the one at Marcheville, in Normandy. At Tocqueville, the phosphates, unlike those occurring in Normandy, are embodied in veins of hard rock, and are exploited by means of underground galleries, somewhat like coal mines are worked. These beds are from one to three feet thick, and also go 30 to 60 per cent. of phosphate.

When still uncrushed, they sell at Bougie, which is the natural port of that region, at £1 10s. to £1 15s. per ton for the richer grades. The milling process they have to be submitted to adds to the cost. The work of quarrying at Tocqueville is done by means of pick and explosives, handled by Arabs, who receive 2s. per day, and are under the supervision of European overseers, who receive 8s. to 10s. per day.

Later on still, at Rio Salado, in the province of Oran, I visited more phosphate formations, where the rocks have a different appearance still. The most important of these formations, which have only been discovered of late years, are at Tebessa, in the

province of Constnatine, at Gafsa, in the province of Tunis. These, I am told, are much like the Marcheville phosphates. However much interested I felt on the question, time would not allow me visiting them.

So extensive are these discoveries, only made of late years, that it is computed that at the present rate of consumption there is sufficient phosphates secured in France and Algeria to meet the demands of French agriculture for nearly 200 years.

While in Paris, at the conclusion of my trip through the vine-growing regions of Europe, I further inquired into the interesting question, and consulted specialists, who entertain favourable views regarding the future discoveries of phosphate deposits in this State, as well as in other regions of Australia.

Mr. Tacussel's Grape Vine Collection.

On my way down to Algeria I broke my journey at Avignon, on the Rhone, and proceeded to the village of Vaucluse, to pay a first visit to one of the most complete collections of table grapes in Europe.

As early as the 14th August, I had an opportunity, under the guidance of the owner, Mr. Alex. Tacussel, who is well known in the viticultural world in France, to examine some of the earliest table grapes in cultivation. Mr. Tacussel has on his trellises, all in the open air, over 500 varieties of grape vines, collected from every available and reliable source. The grapes cover a ripening period which extends from the beginning of August to the end of November.

Later in the season I paid other visits to these collections, and finally obtained cuttings from 14 varieties of special merit, which are quite unknown in Australia, and which I took on board the steamer with me on my return journey.

Some of these grapes, of which a list with description will be submitted separately, will, when propagated and tested, prove valuable additions to the good varieties we already possess.

Algerian Vine Growing.

From an Australian standpoint, a visit to the Algerian vineyards offers at every step useful information and interesting subjects for comparison.

Many of the problems influenced by conditions of climate and of soil, which had to be worked out in Algeria, are also in evidence in Australia.

For a long time Algerian viticulture, worked on the lines of time-honoured methods which obtained in France, was convulsed by occasional disastrous results, and it is not long since Algerian wine was synonymous with unsoundness.

The two chief difficulties confronting the Algerian vinegrowers are:—(1st) The excessive rise of temperature in the fermenting

vats, more especially when the Sirocco or desert wind blows during vintage; and (2nd) the occasional breaking up of the dry season before the grapes can be safely secured.

Both circumstances often resulted in the wine contracting taints and developing germs of disease, which speedily produced unsoundness. These unfavourable circumstances were further aggravated by others, which were inherent to the kind of grapes and to the kind of land the vineyards were on. The grapes consist mostly of very heavy-bearing varieties, rather deficient in those elements which impart good keeping qualities to the wine, and yield a common and cheaper blending article; the second generally rich and forcing alluvial valley land favoured the excessive production in the composition of the grape must of albuminous and other unstable bodies which afford food for bacterial germs of diseases, and constitute an element of danger when present in abnormal qualities.

These problems have since been satisfactorily solved. The excessive rise in temperature has been combatted by a number of methods advocated from time to time by progressive vinegrowers.

One method, however, is now more generally used with good results; that of cooling in water refrigerators, such as are used in dairies, and known as Lawrence coolers.

The occasional partial loss of the grape crop through rotting on the rich alluvial flats, when sodden by the early rains, has since been remedied or obviated by greater despatch in dealing with vintage, and by so organising the cellars that the grapes can be turned into wine quickly without interruption.

As regards the injurious matters which more or less affect the composition of the must, chemistry has suggested corrective means which may be used without injury, and result in a wine possessing better keeping qualities.

These means aim at standardising the chief constituents of grape juice, thereby obtaining more uniform wine, or at least in promoting the activity of these germs favourable to healthy fermentation, and checking those other germs which cause accidents and sickness in the wine.

I propose as opportunity offers to deal at some length with a number of interesting questions bearing on Algerian cultural methods, the mechanical appliances devised for speedily dealing with the vintage, and the method of handling the wine.

As many of these methods are pretty identical all over Algeria, I found that little would be gained by multiplying my visits to a great number of vineyards and cellars; and after inquiring at well-informed quarters, I only visited some of the most progressive and successful establishments in each locality visited.

As a rule, the main object of the vineyard proposition is quantity. The wine is quoted and sold at so much a degree of alcohol in every 100 litres or hectolitre.

The higher percentage the better the juice. If with this they also secure body and colour, so much the better, as the trade does not look to Algeria for wine of high quality, but rather for a sound blending wine, with no particularly striking character of its own, which for that reason renders future manipulations easier.

As intrinsic merit is subordinate to percentage of spirit per standard measure of quantity. The question which the Algerian vinegrower had to ask himself was which was the more profitable, a 50 hectolitre yield at 12° or an 80 hectolitre yield at 10° of spirit.

The advantage has so far been in favour of quantity over quality, although the difference is not in practice so evident as it would seem to appear from the above figures. The heavier yield indeed infers heavier manuring of the land, greater cost of picking and manipulation, and more storage vessels. In Australia, where labour, manure, and caskage are all much dearer, I believe that a lesser quantity of a more valuable article would be more profitable than the larger and cheaper quantity. Whilst in Algeria labour, manure, and storing vessels are so cheap that quantity is more generally sought after than high quality.

As a rule, the Algerian cellars are not designed or equipped for long storing and maturing the wine, which is sold in bulk to Continental merchants and shipped to their order a few months after vintage.

A considerable quantity of grape juice is also shipped to Cette, Hamburg, and other centres of wine manipulation in the unfermented state, under the name of "Mistelle." Spain also supplies considerable quantities of that article. Its preparation is of the simplest, and consists in checking the fermentation either by means of sulphurous fumes or by the addition of a sufficiency of rectified spirit.

Thus prepared, these mistelles are shipped away, and later on when the requirements of the trade are better known they are either freed of the sulphur fumes or diluted to such a point that fermentation will be possible, and are then made into a dry wine, or else they are permanently fortified and turned into liquorous wines.

Algerian Agriculture.

Besides vinegrowing, which capitalists favour as a form of investment in Algeria, other agricultural industries as well help to support a numerous population and add to the prosperity of the colony.

Cereals such as wheat, barley, oats, and millets are extensively cultivated by the French settlers, as well as the native races, notably the Kabyles.

Stock-raising is also an important branch of industry, and one which is best suited to the nomadic habits of the Arab part of the population.

Amongst the most interesting farm stock, from our point of view, are the goats, which are very numerous in Algeria, where several distinct breeds are kept.

Better than either the local Kabyle and the Arab breeds, are two heavy milking breeds, the Maltese and the Spanish.

The white Maltese breed, with long hair, is mostly kept in semi-stabulation, and when liberally fed yields as much as four quarts of milk a day. It is the cottager's goat.

The Spanish breed, which is more common around Oran, is the one which supplies towns with milk. Numerous herds of goats are walked along the streets in the early morning, and customers are served straight from the teat. It is considered a hardier breed than the Maltese, but not such a good milker.

A third breed of goats, which has proved itself to be well adapted for Algerian conditions, is the Angora. The original stock consisted in a valuable draft presented by the Sultan of Constantinople to Napoleon III. This strain, which for a long time was kept pure on a State farm, has however of late years been allowed to disappear, but efforts are now being made to reconstitute it.

The Angora is a bad milker, in fact when poor in condition it hardly supplies sufficient milk for the requirements of its kids. It is otherwise more accommodating than the other two breeds mentioned, and do well on country considered too poor for either the Spanish or the Maltese varieties.

The wethers, when in good order, are no wise inferior to good mutton, and a considerable quantity of the meat consumed locally is goat's meat, as sheep are more favoured on French markets.

Besides shrubs and coarse food which they pick up on the uncleared land, large plantations of prickly pear, more especially spineless varieties, are made as stock feed in time of scarcity. The feeding value of these is said to rank between that of the Jerusalem artichoke and of the field carrot.

As a forage plant for the eastern goldfields, I believe the spineless prickly pears would prove of value.

Another useful tree which is largely cultivated for both stock and human food is the carob tree, several varieties of which, more especially one of Spanish origin, yields pods over a foot long, with sugar contents of 35 to 40 per cent.

A great many of the wild trees are now budded or grafted with the improved sorts. The introduction of these choicer varieties could easily be effected, and the cultivation of the carob bean offers promise of success in our limestone formations of the coastal districts.

The fig constitutes another feature of Algerian agriculture, and in the Kabyle mountains it affords for the dense population which is settled in that part of the Atlas an important article of food.

Some of these Kabyle figs are amongst the best I have tasted, and they moreover possess a firmness of flesh which causes them to carry well. A great number of varieties are cultivated, which are classed into two groups—the Bakour or early figs, and the Autumn figs. A few bear two crops on wood of the previous season, as well as of the current season's growth.

Caprification is practised by the Kabyles, who hang on the bearing trees strings of fruit which harbour the "cynips" fly, which is the agent of caprification.

Of all the plants indigenous to Northern Africa, the date palm is certainly the most picturesque, as well as one of the most useful. Of these there is a vast number of varieties grouped in their main classes—

(1.) The soft syrupy date, of which the Rhars is an example.

(2.) The fleshy transparent, sweet date, of which the famous Deglet-noor or "date of the light" is the best type.

(3.) The dry mealy long-keeping date, which is represented by the Degla-Beida.

The first-mentioned variety or Rhars is one of the earliest to fruit and to ripen; it is mostly consumed locally, and enjoys a high reputation.

The Deglet-noor, which is firmer and carries better, is, without exception, the best date I ever tasted, and constitutes a delicacy which is in great demand all throughout Algeria and even France.

The last-named date, or the Degla-Beida, is, on account of its highly nutritious value and its long-keeping character, in great demand with caravans.

These dates are best propagated by djebars, or offsets taken from female trees.

I brought with me seeds from some of the best Algerian dates, but this mode of propagation is uncertain and lengthy, as seeds give rise to trees which may not produce as good a date as they came from; while the sexes of the resulting trees are about evenly represented, and seedlings take two or three years longer than offsets in coming into bearing.

These, when the conditions are favourable, begin to bear in five or six years.

The probability of the cultivation of the best kinds of dates which never reach us proving successful on inland goldfields wherever a supply of water can be commanded is so great that I think it would be highly desirable indeed that this department took steps to introduce from the right quarters some of the most desirable date palms to grow.

Some years ago a shipment of offsets of some good varieties, was sent from Algeria to South Australia, where I believe they were planted at Hergott Springs, some considerable distance inland, and have there thrived quite satisfactorily. These djebars, how-

ever, were shipped in tubs, which proved a cumbersome as well as a costly means of transport.

Much the best way would be to procure some hardy djebars of 20lbs. to 30lbs. each at Biskra, an important wintering town in Sahara, and where a fairly large trade is done in the sale of these djebars or suckers.

These could be shipped from Algiers, packed in long crates and wrapped in moist moss, then packed and placed on deck in some place sheltered from the spray of the sea water. In bad weather they would travel and arrive in good order.

These djebars cost from 4 to 5 francs each at Biskra, the best coming from Oued-Rir, an oasis some days distance from Biskra.

The Director of the Jardin d'Essai at Algiers would, he assured me, take steps to procure and forward these suckers if they were required.

An important precaution at this end would be to carefully fumigate the consignment to guard against the possible introduction of the date scales, which are amongst the most troublesome pest of that useful tree.

Spain and Portugal.

After a stay of nearly a month in Algiers, I left Oran, the chief town of the province of that name, and crossed over to Spain, landing at Almeria on the 10th September.

My investigations whilst in Spain bore mainly on the fresh grape trade and packing for shipment; on the raisin-drying industry; on the rearing of sherries, and the manufacture of port wine. For that purpose I visited Almeria, Malaga, Xeres, and Oporto.

As a result of my investigations, I am more than ever impressed with the possibilities of Western Australia, more particularly for the production of wines of the sherry, malaga, and port types.

This State, with its dry warm summers, seems to be better adapted for the production of sherries, when suitable grapes are used, than the other Australian States, more especially wines of the "Oloroso" type.

The sherries of Spain are grouped into three classes—

(1.) "Amontillado," a dry, spirituous and ethereal wine.

(2.) "Manzanilla," lighter, both in colour and in body, and made from the same grapes from vineyards grown on the sandy loam of San Lucar.

(3.) "Oloroso," not quite so dry as the previous two, with more body and peculiarly nutty and more generous.

Some samples of West Australian wines I submitted to Xeres tasters were praised and the opinion was expressed that had these wines been submitted to the same treatment that has been found so successful in Xeres, a fine vintage wine would have resulted.

That system, which consists of raising the sherries in "Soleras" I propose to try in this State.

These "Soleras," or mother casks, of the finest wine are breeding foundation butts for wines of good strength. The system is peculiar to Spain.

Each set of cask is numbered, and 1-9th to 1-10th of the contents is left ullaged. After the first year they are not racked and a growth of a white fungus spreads over the surface. The bung hole is simply covered with a porcelain cup, tied by a string to keep it from being broken.

After a few years, when the wine is fit for the market, it is cleared and prepared for shipment. A few "arobas"—a measure holding $2\frac{1}{2}$ gallons—are drawn from a number of the Solera casks and that wine is fined with Spanish clay or with white of egg.

An equivalent quantity of a younger wine of the same type is then restored to each of the Soleras casks, and in the course of a few months this fresh addition has to such an extent been mellowed and refined by the other wine with which it is corporated that fresh draughts may be made from the mother cask, and the process goes on like this *ad infinitum*.

So pronounced are the delicate ethers resulting in the Soleras from the action of air on the wine, under the influence of the fungus growth present in the casks that a few drops of an old Soleras sherry on the handkerchief will reveal the perfume of the wine a day or two after.

My investigations were not confined to the cellars, but I visited a number of vineyards as well, so as to get acquainted with the grapes grown for the production of sherry.

This, as well as other matters, I propose to deal with at some length in special papers.

The sweet malaga, as well as port wines which produce these wines, are manufactured after methods somewhat similar in both cases. The grapes, however, differ as well also as the amount of spirit added to the fermenting juice in the "lagars" or fermenting houses.

The vineyards of the Alto Douro are amongst the most picturesque I have seen and are established on hand-made terraces.

The soil consists of disintegrated schists, which readily crumble down under the pick. As the process of weathering has been going on for ages, and the crumbling rock releases every year some of its stored-up plant food, the necessity of manuring is to a certain extent obviated.

The vineyards of Spain and Portugal have to some extent of late years been reconstituted on phylloxera-proof stock, and a great many green patches of vines are now seen among the barren slopes which once yielded annually their crops of grapes.

Other Crops.

Although vine-growing in Spain and Portugal, as well as in Algeria, contributes in a large measure to the country's wealth, other crops are also in places found highly profitable. Among the most important, especially from our standpoint, is orange-growing, which in Algeria is extensively carried out at Boufarik, Blidah, and around Oran, and in Spain at Valencia and Seville.

As a rule, I found the trees much more scale-infested than ours, more particularly by the scurfy scale (*Parlatoria*), which is unknown in our orange groves.

I located at various places some new varieties, which would prove of great value if introduced and propagated in this State.

Even more important than the orange crops are the olive plantations, which form as characteristic a feature of Spanish landscape, as the date palm does of the inland districts of Algeria.

All sorts of varieties are cultivated, from the small berries rich in oil to the large fleshy Sevillano or Queen olive, much relished when pickled.

In the Midi, or the South of France, are also seen busy important oil mills, but that industry has suffered incalculable losses of late years on account of the olive fly, a pest akin to the fruit fly, introduced into Western Australia with Mediterranean oranges.

Amongst the forest trees of economic worth which it would be desirable to introduce and propagate in this State are two varieties of oak trees.

The Ballota, or sweet acorn oak, which grows on arid, hilly slopes, and supplies abundant harvests of acorns, consumed by large herds of foraging pigs during the autumn months before the killing season. The flesh is said to greatly improve on that diet. The pigs, under the guidance of a swine herd, are turned out from their stone wall pens every morning on to the slopes, where the Ballota oak grows, to feed on the acorns that have dropped during the night.

Ten trees are, on an average, reckoned for each pig.

These oaks are slow growers, but they are extremely hard, and grow where no other vegetation is in evidence.

The Cork Oak is another useful oak which should thrive on our granite hills with as great luxuriance as it does in Algeria or in Spain. The Forestry Departments in the South of Europe are fully impressed with the value of these trees, and carefully govern their exploitation.

When introducing acorns from these trees, it is most important to exercise every care in not introducing at the same time those borer grubs that are often found inside the nut. Some acorns I procured in Spain, with the idea of planting them, on my arrival I had to destroy, as I soon

discovered that they were infested with grubs, which eat the kernel out and only leave the outer shell of the acorn.

Stock.

Of the stock met with in Spain—two, the Catalanian ass and the red pig—would, to my mind, be acquisitions to Western Australia.

The ass is invaluable as a carrier in localities where goods cannot be carted on account of the lack of roads, and enlivens the landscape of almost any part of Spain.

The breed was introduced by the Moors from Northern Africa, where it can still be found pure.

They are, as a rule, of larger frame than the Algerian breed, and produce, when crossed with the Andalusian mare, larger and more docile mules than the Algerian ones, which are out of the smaller Arab and Barb mares.

In Spain, like in Algeria, mules are preferred to either horses or donkeys where arduous work has to be done, and they cost more to buy.

Mule breeding has not been attempted with any method in Australia, and should the State ever attempt to introduce it to stock owners the practice should not be lightly condemned until the better strains of jackasses such as the Catalanian the Gascony and the Poitou varieties are tested. Each of these varieties is found best in its own locality and we have to find out which suits the local circumstances best.

In previous notes I addressed to the editor of our departmental journal I touched on the Spanish red pig, which is one of the best foragers I have met with.

Visit to France.

Any attempt to touch upon the many interesting subjects bearing on vine-growing which came under my notice in the course of my visit through the vineyards of France would unduly lengthen this preliminary report.

I propose describing, with sufficient details, many of the matters contained in my notes.

I visited, after an interval of 12 years, the vine-growing centre of Bordeaux, Montpellier, and the Herault, the Hermitage, Burgundy and the Cote d' Or—all famed for the wine they produce and the methods they adopt.

Some of these methods best suited to our local conditions I shall describe in the pages of our journal.

Whilst in France I also visited the workshops of some of the leading agricultural machinery makers and coopering establishments, and paid attention to the up-to-date laboratory methods of pure yeast culture. I also visited several agricultural stations.

I availed myself of every opportunity of gaining information respecting the fruit export trade, and have collected, on the methods of packing preferred, cost of freight, duty, and other charges, notes which will prove useful to intending exporters.

In conclusion, I venture to express the opinion that the three months that I spent on the mission work I have just outlined will result in many improvements being made in our cultural and manufacturing methods.

I also came back more than ever impressed with the possibilities this State offers from an. agricultural standpoint, even when compared with such flourishing countries as those I visited.

To the British Consuls at Algiers, Oran, Almeria, Malaga, and Xeres, as well as to departmental professors of agriculture and other agricultural officials wherever I have been, I am indebted for introductions which have greatly facilitated my work of investigation, and for courteous help in gaining the information I was seeking.

DISTRIBUTION OF PARASITES.

Report by Inspector E. H. Bailey.

I beg to further report having collected and sent away to various applicants 14 colonies of parasitised, soft-brown scale (*L. Hesperidum.*) These were all collected from citrus trees in Perth, and sent away securely packed for travelling. The parasite of this scale should soon be established well over the State, as colonies have been sent around for some distance.

Quantities of dead Black Scale (*Z. Oleac*) can now be obtained from the branches of oleanders and other shrubs in the Botanical Gardens, where strong colonies of the parasites of same have been liberated from time to time.

I am pleased to report also that the beetle (*Cryptolœmus Montrouzierii*) has become established, and I have found the larvæ and beetles in different gardens in Perth devouring their natural food, the Mealy Bug (*Dachylopius sp.*), on citrus and other trees. Some of these have also been collected and sent away. In addition to the above beetle, further colonies of *Rhizobin ventralis,* a scale feeder, can be sent to those troubled with scale.

OPHTHALMIA.

By R. E. Weir, V.S., A.C.I.S.

In consequence of reports having been received of cattle blindness in the Northam district, I paid a visit to that locality, and have to submit the following for your information:—

As this disease is prevalent among cattle and sheep in various parts of the State at the present time, a description of same, with the necessary treatment, may be found advantageous to stock breeders.

By the term "Ophthalmia" is understood "Inflammation of the eyes," and the outbreak at present is known as the simple form, affecting the outer structures of the eyes such as the conjunctiva and cornea. The cause is due to animals grazing on country where they are exposed to glare from the direct rays of the sun, or to sudden changes of temperature, as from extreme heat to cold winds; or may be brought about from the irritation of dust when animals are travelling on stock routes. By means of flies, dust, etc. the disease is spread from one animal to another, thereby becoming infectious.

Symptoms.

The affected animal will usually be found standing well away from the others and apparently suffering pain, while nearly closed and frequently twitching eyelids drop abundant tears. If the animal is handled for the purpose of examining the eye, it will become violently frightened and make every endeavour to escape. The eye should be exposed without delay by means of placing the finger and thumb respectively upon the edges of the upper and lower lids and separating them, when the conjunctiva will be found to be much inflamed and a white scum formed in the centre of the eye, obscuring the sight.

Treatment.

When one or two animals only are affected, the inflammation should be subsided by means of hot fomentations and the application of belladonna lotion twice daily. This treatment, however, is difficult when a large number are suffering at the same time, and the most effective treatment is then to bleed from the angular vein running down from the inner corner of the eye and apply a lotion of tinct. of opium and sulphate of zinc; or, if this be unobtainable, spirits in the form of pure whisky dropped direct into the eye. This will have a beneficial effect.

Immediately the disease is recognised, the affected animals should be removed and isolated, to prevent its spread.

REPORT ON THE CONSERVATION OF WATER.

By Alf. Blount Fry, A.M.I.C.E., Inspector of Lands.

In accordance with the request of the Honourable the Minister for Lands, contained in your letter 190/870, dated 24-7-03, "to report on the question of Water Conservation, and on such schemes that I am conversant with in Victoria that could be advantageously adopted in this State," I beg to submit the following :—

The first ideas of water conservation which took permanent root in the minds of Victorian people were suggested in a number of admirable lectures delivered all over the arid country north of the Dividing Range by the late Bishop of Melbourne, Dr. Moorhouse. The question was subsequently taken in hand by the Government of Victoria, who requested George Gordon, C.E., and Alex. Black, the Surveyor-General, to report on the subject. These gentlemen took a preliminary tour through the country north of the Dividing Range, examining superficially the various rivers, creeks, lakes, dry lake-beds, and swamps. Having formed their opinion of what the possibilities were, the next step was to collect reliable information as to rainfall and the appointment of surveyors to take flying levels from the source to terminus of the various rivers, fixing permanent level marks that could be picked up again when detail surveys were made.

In the case of the Victorian rivers examined all empty themselves eventually into the River Murray; but before doing so they perform many psychological actions, such as forming immense lakes, filling large swamps, flooding large areas of country, and in some cases apparently getting lost altogether.

To arrive at a clear understanding of these actions, it was first necessary to have careful surveys made of all old channels and watercourses connected with these rivers, lakes, and swamps; also correct and permanent levels established.

When the surveyors had completed the preliminary work, the engineers commenced to devise schemes suitable for each river within its watershed and the flatter country through which they flow.

All these rivers, which flow approximately parallel to each other, have a certain peculiarity not to be found in this State. All take their rise in the Dividing Range, and, after leaving their watersheds, flow through comparatively flat country, with a very little fall to the mile. This slow fall has caused the silt brought down in flood time to be deposited on either bank, which have thus gradually become higher than the adjoining country; consequently, when at their highest level, they run in partly elevated channels.

Occasionally they have burst through their elevated banks, and have formed streams that fill numerous lakes and swamps many miles distant from the parent river. In extraordinary floods in the past the waters of these rivers have been known to meet on the plain country. It will be seen at once that these rivers lend themselves in a natural manner for diversion of water to great distances, either for stock supply or irrigation purposes, when properly controlled and regulated by weirs.

The foregoing remarks are, no doubt, ancient history to most persons, but are mentioned to illustrate the entirely different physical features that exist in that country as compared with the South-West Division of this State.

Here we find two river systems, one that obtains its supplies from the interior elevated plateaux, assisted or supplemented by streams from the Darling Ranges, and the other system, which derives its supply entirely from the rainfall on the Darling Ranges. None of these flow through any large extent of flat country, and all have a rapid fall to almost sea level.

It will therefore be obvious that, in this State, to carry out any large schemes for diverting water for long distances, for stock supply or irrigation, is not feasible; but there is every reason to believe that, on a smaller scale, schemes could be devised that would result in great benefit to settlers, and be of the utmost importance in promoting the future welfare of the State.

I do not consider it is possible to carry out irrigation schemes successfully, except in one or two localities, and even those would be of small extent as to area supplied.

The Department is in possession of plans and a report I wrote some years ago on the possibility of a small irrigation scheme at Cookernup, on the South-Western railway. In that report, which chiefly concerned a scheme for drainage in the flat country at the foot of the Darling Range, I proposed to impound a certain proportion of flood water in a large reservoir in an elevated position that would command the low-lying country, giving a supply during the summer when required for irrigation. Many similar schemes could be designed and successfully carried out in the same locality, where now the trouble is, too much water in winter and a scarcity in summer.

The Gingin country is the only other locality that I know of where irrigation could be carried on, but the brook there runs through private property. The question of riparian rights would effectually prevent the contemplation of any such scheme by the Government.

The earliest efforts for conserving water in Victoria were carried out by the pioneer squatters, who displayed remarkable discernment in selecting very excellent sites on the rivers for erecting their dams, which sites were frequently availed of by Messrs. Gordon and Black in formulating their great schemes of water conservation, and later on were utilised by other engineers.

The first public bodies in Victoria who carried out works for water supply were the shire councils, a body somewhat similar to our roads boards, with this difference, that each council employs a certificated engineer, under whose supervision their works were carried out. These works consisted simply of open excavated tanks at suitable sites, mostly on or near public roads; and also catchment drains for filling natural depressions and dry swamps. The councils were assisted by loans and grants from the Government.

The larger and more important conservation and irrigation schemes were undertaken and carried out by water trusts, the members of which were elected by the ratepayers. Several members of the shire councils were also generally elected members. These trusts appointed engineers who had passed as "hydraulic engineers" an examination board instituted by the Government Water Supply Department. The trusts, after submitting schemes for approval of the Water Supply Department, were granted loans and, by Act of Parliament, were given power to levy special rates for interest and sinking fund.

The works carried out by the water trusts consisted of building weirs on the rivers, deflecting water up-stream for stock supply, and diverting water in part surface channels for irrigation purposes; also filling large storage reservoirs and lake beds previously dry. The filling of the lake beds resulted in a marked difference to the local rainfall, and a great boon to surrounding settlers.

The schemes that might with advantage be adopted in the South-West Division of this State may be divided into four kinds or systems, and should be undertaken in the following order:—

(1.) The making of surface tanks (open excavations, or covered to check rapid evaporation).

(2.) Improving existing waterholes in rivers and brooks by deepening same.

(3.) The building of weirs on rivers and brooks.

(4.) The construction of storage reservoirs in elevated positions.

(*a.*) The making of tanks by excavation is a simple matter that might be undertaken by the various roads boards. Still, the services of an expert would be necessary in the selection of site, laying out the tank (with catchment drains) with proper dimensions, form, and position; the last two being important to avoid rapid evaporation. The best form is long and narrow, steep slopes on sides, easy slopes at ends, the position, where possible, in a north and south direction; fence protection and tree planting on sides are advisable.

(*b.*) The improving of existing waterholes requires care in first ascertaining nature of ground to be excavated, to test for the presence of salt or saline indications, and to avoid rock. This work could also be undertaken by road boards.

(*c.*) The building of weirs requires an experienced engineer to design, after previous exhaustive particulars obtained by a surveyor as to levels, catchment area, extent of deflection, rainfall, and nature of ground for foundations. It is possible, no doubt, that many of the existing bridges over rivers and brooks could be strengthened and converted into low weirs. I would even propose that, in future, no simple bridges should be built over small streams. I would suggest high level crossings so constructed as to conserve water on the up-stream side, and provided with safety bye-washes.

(*d.*) The construction of storage or impounding reservoirs in elevated positions requires experiencēd engineers of the highest skill and ability to design and carry out. The importance of sound construction cannot be overrated; faulty designs and construction have frequently resulted in overwhelming catastrophe, causing immense damage and heavy loss of capital.

It is impossible at the present stage to give an estimate of cost of any particular scheme. The first step necessary is to collect information as to which localities require water supply. This information could no doubt be supplied by the roads boards, who could also point out suitable sites for tanks and weirs.

Information of great value could be obtained from all the surveyors and land inspectors from time to time as to promising sites for conserving water. Such information should be specially recorded in a concise form, so that when an officer is appointed to go into details, he could be furnished with a list of likely localities for schemes.

The question of water conservation is a very great and serious one, and should be considered with the utmost caution and precision; it should be approached under the advice of the calm and matured deliberations of old and experienced professional experts, and not by the rash impetuosity of youth and inexperience. I have, therefore, endeavoured, to the best of my ability, in this report to place before you all the methods adopted in the older State of Victoria of which I have personal knowledge and experience.

MINING REPORTS.

PHILLIPS RIVER.

Report by WARDEN SPENCE.

SIR,—I have the honour to submit, for the information of the Hon. the Minister, the following report on the Phillips River Goldfield and Mining District for the year ending 31st December, 1903:—

The field during the year has shown signs of improvement, more especially with regard to Copper Leases; owing to litigation, unfortunately, the Harbour View mine, a regular producer of gold and copper in the past, has been practically closed down during the year. Great trouble has also been experienced with regard to the scarcity of water, as the heavy rains which fell on the other fields unfortunately missed this district, and the season has been particularly dry, notwithstanding the Floater and Maori Queen mines have been crushing all through the year, and a considerable amount of work has been done on these leases.

During the last quarter of the year the Department of Mines opened an Assay Office in the district for the purchase of copper ore by the State, and during the last three months of the year about 2,335 tons of copper ore have been received at the sampling works, the estimated value of this ore being £16,717, which is rather below the mark, as the gold contents of some of the parcels have not yet been determined, and about £10,000 has been paid to the mine owners, the average assay value of the ore purchased being 15½ to 16 per cent.

The amount of ore purchased proves the ore to be generally of a high grade character, and the quantity purchased in so short a time shows that there is plenty of ore available, more especially as ore below 12ft. is not at present payable.

I consider that with the increasing value of copper, which has risen again in price to nearly £60 per ton, and as at this price low grade ore could be treated, there should be great inducements for capital to come into the district, so that the leases could be worked in a legitimate manner, as up to the present these properties have been worked by prospectors and small mining syndicates; the progress has, therefore, been slow, and the development work small, the greatest depth at present on a mineral lease being only about 140ft., so that sufficient work has not yet been done to prove these leases at a depth, yet from present indications the sulphide ore seems to be permanent. Should a smelter be erected there are some large ore bodies of low value which could be treated, and a large number of miners would be employed.

Owing to the scarcity of rain the crops this year have not yielded such good returns as formerly, but a considerable amount of ground has been cleared.

MURCHISON.

Report by Warden Troy.

I beg to report as follows, on the Murchison Goldfield, for the year 1903, for the information of the Honourable the Minister for Mines:—

Nothing of any particular importance has occurred during the year. Steady work has gone on around most of the old mining centres with varying results. Boring operations which were carried out at Day Dawn and Cue have ceased, and it is believed without any useful result. Only one large gold producing mine exists in the field—The Great Fingall, which yielded 157,272·8ozs. of gold out of a total yield for the whole field of 241,758·28. There is an increase of 26,873 tons of ore crushed, and of 30,944ozs. of gold won on last year's return, but this is due solely to the Great Fingall; so, but for the success of that mine, there would have been a substantial falling off in gold production for 1903. At the close of the year the mining industry had got into a depressed state, due to want of capital, and the consequent stoppage of work on many properties.

About the middle of the year the extension of the railway to Nannine was completed, and it has proved a benefit to the northern parts of the field.

Apart from the output of the Great Fingall, 84,485·48ozs. of gold has been obtained from the mines scattered over the field, and the bulk of this is the product of small mines worked without the aid of outside capital.

It is a cause for congratulation that, although the field has suffered from a deficiency of working capital, the total yield of gold for the year amounts to the respectable quantity of 241,758·28ozs.

PEAK HILL.

Report by Warden Bagot.

Sir,—I have the honour to forward, for the information of the Hon. the Minister, my report on the Peak Hill Goldfield for 1903:—

The year under review has been a very quiet one from a mining point of view. No new discoveries were reported and no sensational finds in existing mines.

The depression experienced on other goldfields appears to have also affected this field. There is no doubt that the condition of the markets and our isolated position, 120 miles from the nearest railway station, has retarded our progress during the past year. With the exception of the Peak Hill Goldfields, Ltd., the mines are owned by poor men, who have not sufficient means to develop their

mines properly, so as to place them in a condition to attract the attention of speculators.

Again in the absence of sensational finds, public attention is not drawn to the field, and persons having money to invest do not visit us.

2. The gold return for the year, taken from the leaseholders returns, is approximately 35,610ozs., showing a decrease of about 1,900ozs. as against 1,902. This is to be debited to the outside leases as the Peak Hill Goldfields, Ltd., show an increased production as also an increased tonnage.

The State Battery has not been kept fully employed through the year, it having only worked during six months, crushing 1,011 tons for a return of 972 ounces of gold, an average of ·96. An amount of 114 ounces of alluvial gold was purchased by the local bank during the year 1903, mostly obtained at the Horseshoe.

3. Only four G.M. Leases were applied for during the year and three miners homestead leases. The number of leases in force at the end of 1903 was 58, with an area of 681 acres.

4. The difficulty of obtaining both timber and firewood for mining purposes is being increasingly felt and even now represents a serious item of expenditure to the larger mines. I can see only one solution of that difficulty, viz., the extension of the railway from Nannine. The line would pass through a large amount of timbered country and besides remedying the above trouble would provide cheap carriage and rapid transit, both of which are important factors in the early development of this field.

Further, the stock traffic is one that will have to be reckoned with sooner or later. During 1903 no less than 60,000 sheep and 4,000 head of cattle passed Peak Hill on their way South. This, of course, meant a considerable amount of business not only with the storekeepers, but with the post and telegraph office, which is largely used by drovers and others.

5. The mining revenue for 1903 shows a small decrease, being £1,316 1s. 6d., as against £1,395 18s. 3d. in 1902. The total revenue from all sources was £2,534 14s. 3d., as against £2,798 7s. 8d. in 1902. This decrease is of course mainly accounted for by the non-payment of rent on a number of leases.

6. The public health has been good, there being no epidemic disease.

The maximum temperature for the year was 110, on 30th January, and the minimum 38·8, on 26th July, 1903.

The year has been a dry one, as only 5·61 points of rain were recorded.

7. In the latter part of the year the Miners' Homestead Leases were inspected with reference to improvements, and a satisfactory condition of affairs was found to obtain.

8. There were four births and nine deaths registered in 1903.

I estimate the population of the field at 600, exclusive of aboriginals, 550 males and 50 females, there being probably 450 people in and around the town of Peak Hill.

9. As you are aware, negotiations have been going on for some time between the department and the shareholders of the "Commonwealth" and "Admiral" (in connection with the Mines Development Act) with reference to assistance in boring on these leases. I am informed that the Assistant Government Geologist paid a visit to Peak Hill a couple of months ago, and that his report was favourable and that boring operations may commence at an early date. I consider it will be to the decided advantage of the district to have the country proved by boring, which I think will justify itself later on.

10. The wells in the district are, I understand, in good order. The Government well north of the town appears to be keeping up a supply as I have heard no complaints about it. Of course it is helped out by supplies from private water shafts at Ravelstone.

11. At the Horseshoe mining has been very quiet. The Horseshoe Goldfields, Ltd., worked their leases under concentration up to the middle of November, when they applied for six months' exemption but only obtained three months, with a condition that they should not get any more unless they could show something done towards obtaining machinery, funds, etc. The gold obtained by this company last year exceeded the working expenses, but doubtless the cost of cartage to the State battery is prohibitive. There are six men digging for alluvial, but I am afraid it is a hand to mouth living, though it is of course always difficult to ascertain exactly how they are doing.

12. I now conclude by saying that I look forward to this year, 1904, showing an all round advance, though I admit that our isolation and a depressed mining market militates against rapid progress, still we hold our own.

Land open for Selection along the proposed Collie-Narrogin Railway.

160 ACRES OF LAND FOR £1.

Free Railway Passes will be granted to Narrogin or Collie, providing applicants prove their bona fides.

It is hereby notified, for general information, that the land within 12 miles of either side of the proposed line of Railway from Collie to Narrogin, on the Great Southern Railway, will be open for selection, under Parts V. and VIII. of the Land Act, 1898, from the 10th to the 24th April next, inclusive, during which time all

applications shall be considered to have been received at the same time, and in cases where there is more than one applicant for any particular piece of land, the Land Board shall decide to whom it shall be granted, after due notice of the place and date of meeting have been given to the applicants concerned, in order that they may appear and give evidence in support of their applications.

The Board will sit at Narrogin and Collie, according to the applications it will be required to consider.

The Land to be thrown open consists of about 800,000 acres, and is suitable for mixed farming and grazing, having been most favourably reported on by experts in agriculture. It has been decided that for six months from the 10th April next selectors shall only be permitted to take 1,000 acres under residence conditions, and in cases where they are eligible to hold a Homestead Farm, they may, in addition, have 160 acres as a Homestead Farm, but residence shall be compulsory for six months during each of the first five years from the date of survey of the holding.

Land guides are stationed at Narrogin, Collie, and at Tarwonga (Mr. W. Gibbs), where lithos., up to date, may be seen, and the guides are instructed to take intending selectors out for two days, and if any longer period than two days is required by any selector or selectors, their own arrangements with the guide must be made. Lithos., up to date, may also be seen at the Narrogin land office, and with the following people:—

Mr. W. Gibbs, Booladding.
Mr. W. Fleay, Arthur River.
Mr. M. Kerrigan, Tarwonga.
Mr. Burrows, Darkan.
And Mr. Dolley, the land guide at Collie.

£1 fee is required on a homestead farm, and a quarter-year's rent on all other applications.

After the 24th April the land referred to herein shall be open for selection in the usual way, that is to say applications shall take priority according to the date of their receipt at the head office, Perth. Particulars as to the timber and utility of this land may be obtained at the offices of any of the Government land agents throughout the State, where pamphlets dealing specially with the country are issued gratis to all inquirers. Any further information may be obtained at this office. The land outside this 24-mile belt, which has been temporarily reserved, will be available under the different sections of the Land Act on and after 17th February next.

R. CECIL CLIFTON,
Under Secretary for Lands.

Department of Lands and Surveys,
Perth, 25th January, 1904.

POULTRY NOTES.

By Frank Robertson.

About Ducks.

From all parts of the State I hear of losses with ducks, chiefly young birds. The symptoms are generally weakness in the legs and loss of appetite.

To successfully rear ducks a few simple things must be attended to. In the first place, although ducks like to be puddling about in water to a great extent during the daytime, they do not like a damp bed at night, dry sand or plenty of litter in the shape of straw and leaves make the best bedding, but should be kept quite clean; if they sleep on wet ground at night, cramp is very likely to occur. Large pure-bred ducks are occasionally subject to leg weakness, in which case the best plan is to keep the birds affected in a shed well littered with straw, and to the drinking water add quinine and iron. Ducks always do best where there is plenty of shade, their big flat feet cannot stand the hot ground at this time of the year, and where they are compelled to walk over hot soil is, I think, a frequent cause of them loosing the use of their legs and tumbling about, as is so frequently seen in Western Australia.

Ducks, of course, like plenty of water to swim and dabble in, but this is but seldom obtainable. In such cases, water should be artificially provided in sufficient quantity to allow them to get a bath in every day, or at least two or three times a week. Grit is a thing that is often neglected by duck-keepers. It is a necessity. Sharp gravel, or coarse sand of some kind, should always be before them. Ducks like any amount of green feed, and their soft food they like in a bulky form. A good way of doing this is to add chaff to the bran and pollard, as green as possible; soak it well in boiling water, and then mix with the meals until it becomes a dry crumbly mass, not at all sticky, as ducks have been known to choke when given sticky food without a supply of water to wash it down.

Ducks were supposed at one time to be tick proof, but such is not the case, as I have seen quite young ducklings dying with embryo ticks fastened on to their bodies.

Cases are reported where ducklings are going off in a mysterious manner. Their owners state that every possible condition is attended to to secure success, viz., good, sound, clean food and water, grit, shade, dry sleeping accommodation at night time, and yet they go weak on their legs, tumble over on their backs, and go off one by one; in such case it may be worms in the intestines, a simple remedy is to mix a little garlic with the food, or give, according to *Farm Poultry* (an American journal), essence of turpentine mixed

with twice its quantity of olive oil, giving one to two tablespoonfuls for a dose for a full-grown bird, and making the dose for young birds proportionate.

The Suppression of Tick in Poultry.

The Stock Department is taking action with reference to the tick pest, an inspector is visiting poultry yards in and around Perth, and quarantining premises infested with the pest. The following is the mode of eradication insisted on, viz.:—All fowl-houses, or premises used for the accommodation of poultry, and all appurtenances used in connection therewith to be dismantled, and all visible ticks destroyed. Such appurtenances, etc., must then be either destroyed by fire, or saturated with boiling water, in order that all ticks or their germs which may be hidden in crevices may be destroyed, then thoroughly saturate with a strong solution of water, phenyle, and kerosene. Should the fowl-houses be in close proximity to or attached to fencing, same must be treated in a similar manner. The whole of the ground area of infested houses, etc., must be strewn to a thickness of half-an-inch with fresh quick lime, and then slaked with water, also the ground within three feet of each side of infected fencing must be treated in a similar manner.

VISIT OF SOUTH AUSTRALIAN AGRICULTURIST.

As the *Journal* is going to press, final arrangements are being made for the visit to this State of Mr. W. C. Grasby, editor of the *Garden and Field*, who, at the invitation of the Government, will spend six weeks in Western Australia, during which time he will inspect and report upon the agricultural areas, and will deliver a number of instructive lectures to farmers. The Advisory Board has decided, owing to the absence of the Minister for Lands and the Acting Director of Agriculture, to arrange the programme for the first week only of Mr. Grasby's visit. The latter will arrive in Perth on Monday, 15th February, and on the following day he will meet the members of the Advisory Board. On Wednesday the business will consist of an inspection of the Swan district, and will include visits to the orchards of Messrs. Ferguson and Lennard, and to other well known properties. Mr. Grasby will be taken to Cannington on the 18th, and on the next day he will go to Armadale, and drive on to Mundijong, where he will be picked up by Mr. A. R. Richardson and driven to the latter's Serpentine property, "The Lowlands." Perth will be reached again at midday on Saturday. In the afternoon the visitor will be driven through

the Wanneroo district. On 22nd February he will proceed to Mount Barker, whence he will work back along the Great Southern Railway. Mr. Grasby will also visit the Eastern districts, which, it is anticipated, will require at least two weeks of his time. The fourth week will be devoted to an inspection of the Bunbury, Vasse, and Blackwood districts. The meeting adjourned till Tuesday, 16th February, so that members might have an opportunity of meeting Mr. Grasby before making complete arrangements for the whole of his stay.

A VISIT TO GERALDTON AND UPPER CHAPMAN.

By Inspector E. H. Bailey.

On Wednesday, 20th January, I left Fremantle for Geraldton. Had a look around the few gardens in the town, which are mostly comprised of oleanders, tobacco plant, a few fig trees, or date palms. These are comparatively free from disease. There is a little black scale which is most completely kept in check by an internal fly parasite. The ordinary bush plants were quite free from this scale on account of the parasite, and only a few oleanders had a little scale on, which was well parasitized. There is also a little mealy bug, but is apparently kept in check by a small lady-bird which was feeding on it. The fruit in the shops was also very clean.

From Geraldton I proceeded to the Experimental Farm. The turnips there, I was told, had been very bad with aphis, but at the time I saw them there was no aphis left.

On Saturday Mr. Wicken, the students on the farm, and myself, drove to Mr. Lauder's place. His orchard is remarkably clean, except for some red, soft brown scale, and I found the lady-bird (*Orcus Australasiæ*) feeding on the red scale. The soft brown scale is now attacked by an internal parasite, the outcome of a colony I sent Mr. Lauder last December, and they have lost no time in getting to work on the scale. I pointed them out to Mr. Lauder. Found the cabbage aphis well parasitized, and the larvæ of Thalpocares moth doing good work. After leaving Mr. Lauder's, we drove to Mr. Jupp's farm; his orchard is also very clean.

On Monday, 25th, left for Northampton, and found a little scale in the gardens here, but mostly well kept in check. Returned to Geraldton, and by steamer to Fremantle, well satisfied with the beneficial work being done by predaceous and parasitic insects in the district visited.

WORK ON EXPERIMENTAL PLOTS.

Mr. T. St. Jack, in reporting on the results of crops grown on the experimental plot at Mount Barker, says :—

"Out of the 10 varieties of wheat sown Allora Spring and Queen's Jubilee are best headed, and I think that Brodie's Prolific will be very suitable for this district. The balance of the plots I did not consider it necessary to strip separate, as with the exception of the bonedust, Thomas's phosphate, and where the superphosphate was used in conjunction with other manures, the result was *nil.* It is quite evident from the results that neither potash, ammonia, or nitrate of soda are required here at present, and I don't think the knowledge has been bought too dearly considering the amount of people that have seen these plots and who should benefit by them. The bonedust gave fair results. I should judge it about seven bushels and Thomas's phosphate about six.

"You will understand that the land on which these experiments have been carried out is considered a sort of "never never" with the other class of settler, but I think you will agree with me that land like this that will give such results with the aid of a little manure is not likely to be despised much longer.

"I should esteem it a favour if you could furnish me with the brand of superphosphate you sent me, and where I should likely get it again. It would be a good thing if the selling of fertilisers were in the hands of the Government, as there is an awful lot of deception practised with them. Speaking for myself, last season I bought two tons of Thomas's phosphate and more than a third of it was damaged.

"The following is the result of the three plots :—

No. 1.—No manure ...	29lbs. ...	1 bushel 56lbs. per acre.
No. 2.—Superphosphate ...	137lbs. ...	9 bushels 8lbs. „
No. 4.—Guano ...	... 130lbs. ...	8 „ 40lbs. „

"Thanking you for the opportunity given of testing the most suitable manures for the district."

[The superphosphate sent to Mr. St. Jack was Law's. Messrs. Couche, Calder are the agents for it in this State.—Ed. *Journal.*]

MONTHLY REPORT.

By Inspector G. Buchanan.

During the month of January, I have to report making inspections of Conditional Purchase Blocks in the Nelson, Sussex, Preston, and Boyanup districts. All harvesting operations have been completed this month, and the general experience is that crops are lighter than usual as the result of the excessive rainfall of the past season, which, for this district, reached an average of 38 inches, recorded at 23 different stations. Notwithstanding this copious downfall the general appearance of the country is as dry as if only half the quantity had fallen, and the problem that confronts stock-owners is how to provide feed to carry their stock and keep them in condition until the grass springs again. Fortunately the dandelion, which holds out much longer than the native grasses, is spreading thickly throughout the ring-barked country; but this plant could well be supplemented with other good summer fodder-producing grasses.

I have within the past week had the opportunity of seeing the *Paspalum dilatatum* growing well and strongly under fairly adverse circumstances. Messrs. Abel, Dickson, and Meagher, on the Upper Blackwood, have each small plots of this fodder plant, and in each case the plants are getting a firm hold of the ground without any coddling. The soil in all these cases is perfectly dry, and all the natural herbage is as dry as tinder, while the *Paspalum* is green and making vigorous growth. Mr. Dickson's plot was grown from seed planted two years ago, and Mr. Abel's was grown from roots simply ploughed in like potatoes last October, and left to make the best headway it could. Fully 95 per cent. of these plants have struck, and are now growing strongly.

Mr. Meagher has a number of scattered plants in an old 15-acre field near his homestead, on which some 600 sheep were enclosed during shearing time. The plants were of course eaten down close to the ground, but have since shot out green and fresh-looking. These are of course only small experiments, of about half an acre in extent, but they are not tried under favourable conditions. The soil has not been specially prepared or manured at all, and is simply a fair average of the land throughout the district, and the plants are growing under conditions that would not be more trying if the plantations were on an extensive scale.

So far as I am aware, the settlers in the Blackwood district have not had the advantage to be derived from the establishment of experimental plots in their midst, and I would suggest the advisableness of trying fodder plants in this district, so that every settler may see for himself the results achieved.

Board of Agriculture and Fisheries.

Farmers' Co-operative Societies.

The growth of voluntary co-operative associations of farmers for the promotion of their common interests has been a noteworthy feature in the history of agriculture during the past quarter of a century. This movement has hitherto found its greatest expansion on the Continent, where also it has been longest established; but within the past ten years there has been a remarkable development in this direction in the rural districts of Ireland, and the principle of combination has also been applied with success to the dairy industry in British Colonies and the United States. On the other hand, among agriculturists in Great Britain co-operation has not yet made much progress, though owing to the efforts of the Agricultural Organisation Society, the advantages to be obtained by it are slowly becoming more generally recognised by British farmers.

Some of the earliest co-operative associations established on the continent took the form of credit banks or agricultural loan societies, which now exist in large numbers in regions occupied by small holders and peasant farmers, particularly in Germany, Italy, and Belgium. Briefly stated, their object is to enable their members to borrow small sums at a low rate of interest for the purchase of farming requisites. In Ireland small agricultural credit banks have been established in many districts under the auspices of the Irish Agricultural Organisation Society. A few village banks of this kind have also been started in England during the past ten years. Particulars of the organisation of these institutions may be obtained from the secretary of the Co-operative Banks Association, 29 Old Queen Street, Westminster, S.W.

Next to the banks, the most common, and perhaps the most effective, form of combination amongst farmers is to be found in the joint purchase societies or agricultural trading associations. Their usual function is to purchase *wholesale*, manures, feeding stuffs, seeds, implements, and other articles used on the farm. By purchasing in large quantities direct from the manufacturer, these societies are able to obtain supplies for their members at wholesale prices. In this way they not only help the small farmer to procure his manures and feeding stuffs at a more moderate price than he could do by purchasing for himself alone, but they also save him a large part of the incidental charges usually incurred by the individual buyer in the carriage and testing of the goods. For instance, only one analysis is required of a fertiliser or feeding stuff consigned in truck-loads to the society to test the quality of the several portions of the consignment bought on behalf of individual members, while each member benefits by the lower rates of carriage obtained by collecting sufficient orders to make up loads of four tons and upwards.

Co-operation in production has been applied with greatest success to the dairy industry. The remarkable development of the butter trade of Denmark is attributed largely to the establishment of co-operative dairies and creameries, which have enabled the farmers of that country to supply the British market with immense quantities of butter of uniform quality. Uniformity in flavour, in appearance, and in consistency, is the characteristic most required in butter intended for general consumption in the great towns of this and other countries; and it is obvious that this is more likely to be secured by manufacturing the article in dairies which can manipulate the milk supplied by a large number of farmers than if each of these farmers himself makes butter from the milk produced on his own farm. A full account of the organisation and methods of the Danish dairy societies and of similar associations in Sweden and Germany, is given in a special report published by the Board of Agriculture, and articles showing the progress of co-operative dairying abroad, in the colonies, and in Ireland have appeared from time to time in the pages of the Board's Journal. Except in the case of butter and cheese making, little advance has been made in the application of co-operative principles to productive processes in agriculture. Danish farmers have, however, associated for the curing of bacon for export, and there are also instances abroad of agriculturists having combined with satisfactory results for the prosecution of such businesses as milling, baking, distilling, the preservation of fruit and vegetables, sugar refining, the manufacture of starch, and the raising of seeds.

Co-operation in the sale of general agricultural produce presents difficulties which have not yet been successfully overcome. When it is remembered that corn, vegetables, and meat are usually sold wholesale in separate markets under entirely different conditions, it is not surprising that comparatively few farmers' associations have attempted to undertake the sale of all these articles on a large scale. These difficulties are less conspicuous in cases where the societies have confined their business to a single class of produce, such as butter and eggs, and the wholesale disposal of these products on co-operative lines has been organised with success. Where this business has assumed large dimensions, as in the case of the sale of butter manufactured in the Danish and Irish dairies, the work of distribution is undertaken by special agencies formed solely for that purpose, to which the dairies consign their produce. This form of co-operative distribution is one which offers great possibilities in connection with the question of the economic carriage by rail of agricultural produce. Many of the complaints made by farmers of excessive and preferential railway charges arise from the fact that the consignments concerned are not sufficient in bulk to enable the companies to handle them with profit at the lower charges at which they convey larger consignments. In such cases the remedy would frequently be found in the formation of a co-operative distributing agency, which would undertake the collection and packing of small consignments to make up truck-loads for dispatch at regular intervals.

Retail trading has been taken up by some co-operative societies in dairying districts on the continent, through the medium of the parcels post, and this means of reaching the consumer direct has also been employed for the distribution of fancy cheeses, honey, eggs, and fruit.

Among the other co-operative institutions established by farmers on the Continent, perhaps the most important are the associations for the improvement and insurance of live stock, which are more numerous in France and Belgium than elsewhere. As a rule cattle are the animals with which these associations are concerned; only in a few instances are horses, sheep, and swine included. In the case of the Belgian cattle insurance societies, which may be taken as a type of these institutions, the usual compensation allowed to members for the loss of an animal is two-thirds of its value, and this is paid out of the funds of the society, to which all the members make periodical contributions. Another method adopted by some societies is to pay the compensation out of the common fund only when the animal is declared unfit for food; but if the meat is suitable for human consumption it must be purchased by members of the society, each contributing to the price a sum proportionate to the number of animals he has insured in the society. In some societies there is, however, no common fund, and then the practice is to compensate the owner of a condemned animal by levying a subscription on all the members to make up its value if the meat has been seized; or if the meat may be used for food, then the society purchases the carcase and distributes the meat amongst the members at an agreed price. In this country so-called "Cow Clubs" are sometimes met with among cottars and farm servants for the purpose of compensating the members in the event of the death of their cows, but unfortunately the custom of keeping cows by cottars is not so common now as formerly, and many cow clubs have been dissolved.

All the forms of association to which reference has been made have been adopted to a much greater extent by farmers abroad than by the agriculturists of the United Kingdom, and are one important cause of the success of the foreign competiton in fresh agricultural produce, such as butter and eggs, which is now felt to so large an extent by the home producer. The co-operative movement has, however, made much progress amongst Irish farmers since the work of organisation was taken up by the Irish Agricultural Organisation Society in 1894. At the end of 1902 there were in Ireland 712 farmers' co-operative societies, with 71,023 members. These included 122 agricultural societies, 334 dairy societies and auxiliary creameries, 145 agricultural banks, 31 poultry societies, 49 home industries societies, 18 bee-keepers' societies, and 13 societies with miscellaneous objects, such as the promotion of the flax industry and fruit growing, and including also three federations of societies.

The chief function of the agricultural societies in Ireland is the joint purchase of agricultural requisites, especially manures. Some of these societies have also undertaken sales of live stock;

others have been useful in procuring implements and spraying machines, which are hired out to the members at a small charge; and three have hired grazing lands and let them out at reduced rents to their members.

The Irish dairy societies or creameries, whose main business is the manufacture of butter, are organised on the lines of similar associations in Denmark, and their process of butter-making follows closely the Danish system. Few of the Irish dairy societies were started with sufficient share capital to cover their outlay in buildings and machinery. In many instances credit was obtained from the contractors, or the extra capital required was raised by means of a loan from a local bank. The shares in the dairies are owned, for the most part, by the members. In some cases, persons who do not keep cows hold shares, but they have become shareholders to help the associations as social institutions rather than for the purpose of investment. Shares are usually taken up by farmers in proportion to the number of cows they keep, at the rate of £1 for each animal. This arrangement, however, is not uniform in all the societies. It is the practice to pay for the shares by instalments, generally of five shillings at a time. After the creamery has been started, these instalments are frequently paid in milk: sometimes a reduced price is allowed for the whole of the milk delivered, and sometimes the member delivers a certain quantity free of charge, until the call on the share is paid up. The liability of the farmers is, in all cases, limited to the amount of their shares.

The accounts for 1900 of 195 of these dairy societies, with a membership of 33,064, showed a paid-up capital of £77,282, and a loan capital of £46,204. The value of their buildings and plant, after allowing for depreciation, was estimated at £130,818. The quantity of milk handled by them in the year was 37,162,000 gallons, from which 15,394,500lbs. of butter were produced. The average price paid to members for milk delivered to the societies was 3·97d. per Imperial gallon; and the net profit on the operations of all the societies, after deducting working expenses, was £14,576.

The co-operative poultry societies in Ireland have confined themselves as a rule to the collection and sale of eggs on behalf of their members, but some of them have recently embarked in the table-poultry trade. They purchase eggs as well as poultry from their members *by weight*, and the introduction of this practice is said to have had the effect of making poultry-keepers more interested than before in maintaining a good breed of fowls.

In every case the price paid for the eggs sold through the societies has been above that obtained before they were started. It is claimed that the societies have accomplished an incalculable amount of useful work for the poultry industry of Ireland by raising the standard of quality, by introducing new and improved methods of keeping fowls, and by procuring for their members birds of serviceable pure breeds.

In Great Britain the co-operative movement has hitherto advanced very slowly amongst agriculturists. There are, however, several old-fashioned associations for the joint purchase of manures in England, and a number of similar bodies exist in Scotland. Among the English institutions of this class, one of the oldest is the Lincolnshire Farmers' Association, established in June, 1868, for the purpose of purchasing genuine phosphatic manures of guaranteed quality, and supplying the same to its members at cost price. This society is organised on a strictly co-operative basis: no profit is made on its transactions, and the working expenses are defrayed by an entrance fee of twopence per acre on the land occupied by each member, and by a fee of one shilling per ton on the goods ordered. All manures are analysed free of cost to the members and delivered carriage free within a a certain area. In 1901 this association distributed 6,400 tons of superphosphate to its members, and its accounts for that year show a turnover of over £19,000. It is maintained that by the influence of the Lincolnshire Farmers' Association, the price of manures has been considerably reduced, and that consequently thousands of pounds have been saved by the members, and by others connected with the cultivation of land within the sphere of the Association's operations.

A few other Farmers' Supply Associations exist in various parts of Great Britain, but most of them differ from the Lincolnshire Association in the sense that they are run as large stores or companies with considerable share capital upon which dividends are paid.

In addition to these large associations, there are to be found, here and there, in some of the western counties of England, local manure clubs working on a small scale on the lines of the Lincolnshire Association; and a number of analytical societies of the same type exist in Scotland; but the benefits to be gained from the formation of societies of this class have not yet been recognised by the great body of occupiers of small holdings and allotments South of the Tweed, amongst whom there is a great scope for all forms of co-operation.

The task of organising agricultural co-operative associations in Great Britain has been recently taken up by the Agricultural Organisation Society, which has been founded for the same purpose as the kindred society in Ireland. The objects of this society, as stated in their report, are to secure the co-operation "of all connected with the land, whether as owners, occupiers, or labourers, and to promote the formation of agricultural co-operative societies for the purchase of requisites, for the sale of produce, for agricultural credit banking and insurance, and for all other forms of co-operation for the benefit of agriculture." The society carries on its work by sending organisers to address meetings and to give advice as to the proper course to be pursued in the formation of local societies; by providing model rules for such local societies; and by publishing leaflets from time to time dealing with the

various forms of agricultural co-operation. The local societies affiliated to this central organising agency already number 52, including 29 co-operative agricultural trading societies or joint purchase associations, six dairy associations, one for the production of cheese, three allotment societies, one basket-making association, six combining the purchase of agricultural requirements and the sale of produce, four joint purchase societies also undertaking the improvement of stock by the purchase or hire of pedigree bulls or boars, one entire cart-horse society, and one land association. Many of these bodies have only recently commenced operations; but as an example of the advantages of co-operation to the small farmer, reference may be made to the published accounts of the work already accomplished by two or three of them.

The Muskham Agricultural Society may be quoted as an example of an agricultural trading association. This was started in May, 1899, with 17 members and a share capital of £16. In 1900 the membership had increased to 38, and the turnover amounted to £365. One of the first steps taken by the society was to purchase a reaper and binder with money borrowed from a bank on the joint personal credit of the committee. The scale of charges for the hire of the machine was last year fixed by the committee at the rate of 4s. 6d. per acre, the society providing twine, and a man to take charge of the machine and horses. The result of three seasons' work has been that the society has liquidated the debt to the bank and the machine now belongs to the members, who can avail themselves of its use at a nominal charge just sufficient to cover wear and tear.

Some of the agricultural trading societies are also able to assist in the improvement of the live stock kept by small farmers by purchasing or hiring first-class bulls, boars, and stallions. The Tregaron Agricultural Society, a small co-operative body of 50 members holding shares of 5s. each, of which 1s. 6d. is paid up, has, in addition to its business in manures, cakes and seeds, secured for its members, free of charge, the services of a boar, which is hired out to non-members at a fee of 2s. 6d.

Among the affiliated dairy societies, mention may be made of the Brandsby Dairy, in Yorkshire, which is chiefly engaged in the sale of butter, cream, and cream cheese on behalf of its members, but also undertakes to supply them with manures, feeding stuffs, and other farming requisites. A small warehouse has been rented by this society from the railway company, in which the manures, cake, and other articles purchased in bulk are stored, and from which they are distributed to members as a return-load for their carts which have brought produce to the station. By purchasing in truck-loads and relieving the dealer of the risk of bad debts and the trouble of collecting small sums of money from a number of individual buyers, this society has been able to obtain reduced quotations by which every member has benefited, however small his purchase.

The local societies affiliated to the Agricultural Organisation Society* are registered under the Industrial and Provident Societies' Act, and can therefore sue and be sued as corporate bodies.

The foregoing examples are sufficient to afford some idea of the directions in which farmers, and particularly occupiers of small holdings, can effectively combine to their mutual advantage. Hitherto the Agricultural Organisation Society has been working single-handed to encourage and assist such combination; but its efforts can now be seconded by County Councils in rural districts where co-operation is likely to be useful, the Board of Education being prepared to sanction the teaching of the principles and practice of agricultural co-operation in the case of all County Councils which may make application to them in terms of Section 8 of the Technical Instruction Act, 1889, provided the Board are satisfied that such a form of instruction is required by the circumstances of the district.—Leaflet No. 97, Board of Agriculture, England.

THE FRUIT EXPORT TRADE.

Increasing interest is now, throughout Australia, being devoted to the development of the trade in fresh fruit with Great Britain, and there cannot be the least doubt that with proper care the industry should rise to great proportions, for there is a demand in Great Britain at certain periods of the year for fruit which only the Southern Hemisphere can supply, and Australia should undoubtedly take a very leading place in meeting this demand. Tasmania at present leads the van with its great export trade in apples, and the continental states are now beginning to make a show. For instance, this year alone something like 500,000 to 550,000 bushels of fruit will be shipped to England, but the danger to shippers lies in the cool storage conditions on the mail boats, which do the bulk of this trade. On this important subject a shipper who had sent numerous consignments to Europe, and has an expert knowledge of cold storage, has been writing to the Melbourne *Argus*, and his remarks are worth careful consideration. He writes :—

"The system of providing cold storage on some of the steamers, though suitable for the meat and butter trade, for which it does not matter how low the temperature may be, is very difficult to control for fruit, which has to be kept uniformly at 36 deg. to 40 deg. The cold air enters the chamber at 40 deg. Cold air is driven in one side near the top, and is drawn off through corresponding openings on the opposite side; but there is no efficient device for distributing the air uniformly, and when it enters from the shoots it

* The Secretary of the Agricultural Organisation Society, Dacre House, Dacre Street, Westminster, to whom the Board are indebted for assistance in the preparation of this leaflet, will be pleased to furnish information and afford advice to persons interested in the formation of agricultural co-operative societies.

is often a long way below freezing point, and fruit stacked near these is often frozen and ruined. Then the fruit is frequently put into the chamber at a temperature of 70 deg. to 80 deg., instead of being cooled down to the proper standard, and, in order to cool down the contents of the chamber to 40 deg. cold air is driven in many degrees below freezing, until the thermometer indicates the average of the chamber to be the right one; but there being no proper system of circulating the cold air, long before the bulk is cooled down to 40 deg. portions of the cargo may be frozen. Efforts are made to protect the fruit from the blast of the shoots, but they are very crude. Self-registering thermometers, such as are now used on the Atlantic boats, would be a great help to the engineers. They can be so arranged that an accurate register of a number of points in the cool chamber can be recorded for every hour of the journey.

"In some of the steamers, as, for instance, those of the White Star line, the air is cooled in pipes circulating through brine tanks, and enters the cool chamber at the temperature at which it is to be kept, and the danger of freezing is thus avoided. As these vessels only provide monthly service, and go round the Cape, taking 48 to 50 days, as against 40 to 42 days by the mail boats through the Suez Canal, the majority of shippers prefer the shorter journey. I am quite certain that cold storage will be sufficiently improved to enable pears, plums, grapes, and peaches to be sent to Europe in good condition. Look at the excellent order in which the Californian pears, plums, and peaches arrived here this year; and although it is true the voyage is only half the time of that to Great Britain, yet in an even temperature of 35 deg. to 40 deg. the fruit would carry in perfect order over the longer distance. In some of the experiments under the 'Sutherland process,' when this condition was obtained, delicate pears were carried *via* the Cape, and after a voyage of eight or nine weeks, landed in London in perfect order. There is no branch of the export trade of more importance to the Commonwealth than that of perishable products, and the shipping companies are directly interested in fostering its expansion. It has been, and will continue to be, a profitable trade to them. A strong appeal must be made to them to enter more earnestly on the work of perfecting cold storage transport. The progress of the whole Commonwealth in fruit-growing depends largely on the success with which this can be done."

In a more recent article the same paper said:—"This trade in the carriage of perishable products over the long sea journey from Australia to Great Britain has been 12 or 13 years in operation, and during that time it has expanded with great rapidity. For butter, meat, and rabbits the system of cold storage provided appears to be admirable, and there are few losses in transit, although, at the beginning, when the details of the business had not been mastered, they were common enough.

"But with fruit it is different. Year after year growers and shippers suffer more or less from portion of the cargoes being landed wet and frozen, and either unfit for sale or only fit to be

sold at such low prices as to depress the market rates all round. This is unfortunate, because the expansion of the fruit industry of the Commonwealth depends on the degree of success attained in cold storage transport.

"The oversea markets for fruit are practically unlimited Great Britain pays six millions annually for fruit imports, and Australia has the remarkably favourable natural condition of the reversal of the seasons to those, not only of Europe, but of the United States and Canada. This gift of nature is more precious to the fruit-grower than to any other producer, and he has only to be provided with cheap and reliable cold storage in transport to enable him to place his freshly-gathered crop on the markets, both in Europe and America, at a period of the year when European and American orchards are out of bearing.

"On the other hand, the products of Californian orchards are finding their way to Australia during July to October, when we have no fruit of our own, and when local growers have nothing to fear from Californian competitors. Anyone who has taken notice this year of the admirable condition in which Californian apples, and such perishable fruits as pears, plums, and peaches, have appeared in Melbourne shop windows cannot fail to realise that, with the same care given to the Australian service which has been bestowed on carrying this American fruit, the orchard industry of the Commonwealth would expand rapidly, and the export trade in fruit grow to great dimensions.

"As an illustration of the care and reliability which traders expect to receive from the American companies, it may be mentioned that a well-known Collins-street doctor, whose hobby is lily-growing, received a letter the other day from a Californian bulb-raiser offering to ship lily bulbs at a guaranteed temperature all the way through to 40 deg. The ideal temperature for the fruit chamber is 36 deg. to 40 deg., and it is because this is not regularly maintained on ships to England that so much of the Australian fruit is landed out of condition.

"It must not be supposed, however, that the shipping companies are indifferent to the importance of this trade. Constant care is exercised to obtain reliable reports on each shipment, and to encourage the engineers to take pains to land the cargoes in good order. Very large sums have been spent by the mail companies in insulating cold storage space, and the White Star line has done the same. A great deal of the loss is attributed by the companies to the failure to cool the fruit down before it is placed in the ship's cool chambers, and they intend to urge upon the shippers the importance of seeing that all fruit is properly cooled before being placed on board."

This last point is most important, and it is in connection with matters like this that there is ample legitimate work for the various State Governments and for the Fruitgrowers' Associations. Indeed, the Chamber of Agriculture of N.S.W. might well take up this important subject, and carry it through.

SHEEP TICK.

The following interesting paper was recently read by Mr. W. F. Cooper, B.A., F.C.S., F.Z.S., at a meeting of farmers in England:—

"He commenced by saying that in all the recent work no one had made a thorough study of the anatomy of the animal; and this he considered the very first essential to a proper understanding of its life history, and of the diseases with which it was associated. It was, he admitted, a very difficult task to dissect these ticks, but he had now succeeded in doing so, and of one animal alone he had cut 5,000 sections, completely revealing the internal and external structure of the animal down to its minutest details. He had examined and dissected several hundreds of Ticks in his work, secured from Germany, Africa, and Australia. All Ticks passed through four stages. Each female was capable of laying thousands of eggs, the genital organs being situated underneath the head. As the eggs were laid a gummy substance was exuded from one of the glands, and in this way the eggs became attached to the body. The larvæ from these eggs had three pairs of legs and no genital or breathing organs. Subsequently these moulted (so to speak) and became "Nymphs," still in the same condition as regards the legs and genital organs, but having breathing apparatus. Finally the Tick emerged complete with its four pairs of legs. It is only the female of these which sucks the blood of animals; the male simply performs its functions and dies. The whole process occupies about four months, but this period varies very greatly according to the weather, being much longer in the winter than in the summer, so that ticks hatching in the spring would become mature and lay fresh eggs for the autumn.

"The head of the pest was an exquisite structure, containing six appendages, the two outer protecting and overlapping the inner ones. The two upper appendages end in three perfect teeth or saws with which they cut their way through the skin. The other two inner appendages were clothed with a sort of coat of mail, having serrated edges like fish-hooks which pointed backwards, and when once the sheath got into the sheep you could with difficulty pull it out. The legs had hooks beautifully adapted for moving about in the wool, and he had found an organ, erroneously stated to be a hearing organ, with an attachment which fell against two hairs according to the position and therefore the direction in which the animal was travelling, thus guiding it to where it wanted to go. It had a beautiful breathing organ, consisting of a plate with a slit in it fixed on to a network like wire netting. The animal has no blood, and the air goes straight to all parts of the body without the complicated arrangement possessed by men and

other animals. There is a wonderful bellows arrangement to pump the air. He had found on dissecting the head a complex set of organs which had been claimed by other writers to be organs of sight, but which he was satisfied were organs of smell. These animals had an intensely sensitive sense of smell.

"Various kinds of Ticks attacked various parts of the body, one the head, another the belly, and so on. It was these organs of smell which guided them to the part they wanted. He also found some delicate glands by which the animal secreted fluid for protecting the blood from coagulating, and to assist in digestion.

"There was also a beautiful organ acting exactly like a pump, which was used to draw the blood from the sheep. Like the worm, the gut passes through the brain on its way to the stomach. There are seven lobes in the brain, the two first ones give off nerves to the head, the next four nerves to the legs, and the last one nerves to the gut, etc. The Tick is the medium through which many diseases are communicated, such as Red Water, Texas Fever, Louping Ill, Canine Malaria, Heart Water, Mexican Fever, Rocky Mountain Fever, etc. As to these he was now conducting experiments, the results of which he would report later.

"These diseases were produced by micro-organisms, which were sucked up by the animal with the blood. These lived in the body of the Tick, and were communicated to the next animal it attacked. No investigator had hitherto noted the glands through the medium of which these microbes could live in the body of the Tick, but he had found a very delicate and beautiful set of glands communicating with the mouth exactly in a position favourable for this purpose, and upon these he was experimenting.

"There was a sharp line of demarkation as a rule as to parts of the country where no Ticks existed and of those parts where they abounded, probably associated with the geological conditions, as a Tick passes a certain portion of its life in or on the pasture. Cattle affected, say, with Texas Fever, on which every Tick had been destroyed could not communicate the disease to unaffected cattle, but a single Tick from an infected animal placed on another animal developed the disease. This had been proved over and over again by elaborate experiments in the United States. If only they could exterminate the Ticks all these diseases which they propagated would cease. How was this to be done? There were certain portions of its life spent on the pasture. If, therefore, the pasture could be treated with something fatal to the Ticks a great percentage of the pests must disappear. The ingredients which could be applied by sheep dipping were practically well known.

"Sulphur was perhaps the best insecticide of the world. It decomposed and gave off poisonous gases fatal to insect life. These gases were absorbed and passed through all the organs of the body. If a person took sulphur internally, for instance, it would permeate the body and pass out through the sweat glands. A silver coin suspended round the neck would be blackened. Arsenic had likewise

this property, but acted in a different way, while the subtle compounds of arsenic and sulphur found in the best dips retain in this way a protective power for weeks and even months. Carbolic acid and tobacco to a lesser extent would produce the same fatal results.

"The whole matter of extermination could only be satisfactorily demonstrated by a set of experiments, a scheme for which he had formulated. Each of them would require separate fields, surrounded, if possible, by water, and in each of these a separate set of experiments would take place alike on the pasture and on the sheep. Mr. Cooper said he would gladly assist in the carrying out of these experiments if the Society cared to undertake them. They could choose their own remedies, so long as they contained the essential killing ingredients, from where and whom they liked, and he would be happy to contribute £50 towards the cost. He only wished there were other scientists investigating this interesting subject which was really of the greatest interest to farmers.

"The lecture was illustrated by the limelight, with a series of beautiful drawings of sections of the Tick and its internal structure, by means of which the lecturer was able to explain the various discoveries he had made during his investigations, and was listened to with the utmost interest.

"Mr. C. J. Gilbert being called upon by the chairman for a few remarks, stated that the paper came at an opportune time just as the County of Kent had resolved upon compulsory dipping. In his view the success of the County Council in this step, associated as it was with Scab eradication, would depend largely upon the sympathy of the farmers; and this would depend in its turn upon the regulations which were adopted and upon the methods with which they were carried out. The question of dipping required expert treatment. The police were already over-burdened with a hundred other duties, and how could they be expected to be experts on a subject of contagious diseases and to devote the time necessary to the work the County Council had taken in hand? A special expert at the head of affairs, supported by divisional officers who thoroughly understood the subject, to whom the farmers could turn for assistance, with the knowledge that their wants would be dealt with in a sympathetic manner, would go farther than anything else to make compulsory dipping a success. These inspectors would also have charge of the work connected with other contagious diseases. Such a system already existed in Lincolnshire with most beneficial results."

BEE NOTES.

Now that the gum trees are coming into blossom, arrangements should be well in hand for the honey flow that will follow.

The honey flow season, so far, has been the worst known for a number of years.

Bees in a number of localities require feeding this season. Do not allow them to starve.

The following is from a London report on honey sales:—

"The best English honey is miles ahead of any other in flavour, and brings here 1s. per lb. Next comes New Zealand honey, about 45s. per cwt., retail 9d. to 10d. per lb., frequently sold as English. N.Z. honey is similar in colour to English, but not quite so good in flavour. The largest supply of honey comes from the West Indies, ranging up to 30s. per cwt. for best white; retailed at 7d. to 8d. per lb. Australian honey is very superior to this honey. The reason Australian honey does not sell is because it is dumped into the auction mart and sold by the ton. When the beekeepers combine and send their honey to England to some retailer as an agent, properly grading the honey out there, and getting it put into suitable jars here, then, and not till then, will decent prices be obtained. Put on the market to be retailed at 6d. per lb., Australian honey will sell like hot cakes. At present it is not on the market; when it was, it was bought by the retailer at 2d. per lb., put into a pot, and sold at 10d. per lb."

Cure for Foul Brood.

In the evening, after the bees of a diseased colony are all in the hive, shake them into an empty box. Be sure and get every bee. Have the box ventilated with a piece of wire cloth. Remove the box to a cool place and leave undisturbed until the morning of the second day, or until some of the bees begin to drop to the bottom of the box on account of starvation. Then prepare a syrup of sugar and water, half and half, stirred up cold. Into every tea-cup full of syrup put four drops of carbolic acid, and feed with a pepper-box feeder. Leave them in the box until the evening of the next day after beginning to feed. To prevent swarming out, and to give them a start, put a frame of brood taken from a colony you are sure is healthy into a hive, and fill balance of hive with empty combs. I do not like the use of foundation in such cases. Use combs that never had any brood in, and you know are clean. Empty the bees into this hive and feed a few days with the medicated syrup, and they are cured to stay cured. I burnt out the hives of the diseased colonies with coal oil. I do not believe it is safe to use them otherwise. The combs I melted into wax; and the frames were dipped into boiling water and used again. By this plan all the bees can be saved, no matter how badly they are diseased.—*Exchange.*

DRAUGHT HORSE BREEDING.

By Cosmos.

The question of how we breed heavy draughts for the market at a time like this, when, perhaps, the best only are found to be profitable to the producer, becomes a problem that is worthy of our most careful study, and cannot be too fully answered. It is a fact too apparent to need any convincing argument that only the best heavy horses will bring a satisfactory return to their breeder; and how to breed the best is the matter in hand.

A common error prevailing among farmers is that if they breed any kind, or breed, or pattern of a mare to a horse that is generally recognised as being a good one, they think the result should be the desired one, and that they should have something very desirable from the union. It is a fact that they are often doomed to disappointment, and as often condemn the sire and the sire's breed by reason of the failure, perhaps, of their first attempt at an improvement. This must strike the reader as being a poor test; but by many of our farmers it is deemed sufficient and satisfying, and they at once determine that the experiment is a failure. The next year finds them casting about for a different sire, of a different breed. This is kept up from year to year, and we find them at the end of a few years with a little of this, a little of that, and not much of anything; certainly not with a desirable or uniform lot of horses of their own breeding for sale.

Now for the remedy. As an aid to help you in determining what sire you should use, try, if possible, to get some stallion that has a reputation for siring a class of horses that has been sought after by breeders generally. If you can see a number of his colts it will be a further aid, and should prove quite a valuable object lesson.

If possible, throw prejudice aside, and, even if the stallion does not happen to be of your favourite breed, use him. Taking for granted that in the course of due time you have colts from this breeding, we would then advise that you retain your best mare foals, and part with them under no ordinary circumstances, for in them you have the foundation on which the whole structure of success must be erected.

Give these fillies a liberal allowance of feed, and keep them growing and thriving, believing that feed always cuts quite an important figure with the successful breeder. When these young mares reach a suitable age, use your best judgment in breeding them back to a sire of their own breed and kind; and if they have any weakness, look for a sire that is particularly strong where they are weak. Then go on from year to year without deviation or shadow of turning; and the writer can speak from experience that nothing but success awaits you in the end.—*Farmer and Grazier.*

PARTURIENT APOPLEXY.

Parturient Apoplexy, also called Milk-Fever, Dropping after Calving, etc., is a disease of cows, more especially of milking breeds; and chiefly occurs at the time when they have attained their fullest milking capacity. It has been recognised for generations and has been a fruitful cause of loss to the agricultural community, the deaths in many instances averaging from 40 to 60 per cent. of all cows attacked.

Symptoms.

The disease generally commences within from 12 to 48 hours after an easy parturition, but it may be delayed for a few days longer. (In only extremely rare cases has it come on *preceding* parturition, or *later than* six days afterwards).

The first noticeable feature is sudden cessation of feeding, rumination, and lacteal secretion, with uneasiness, moaning, dull expression of the eyes, paddling of the hind legs, rapid breathing, swaying from side to side, knuckling over of the fetlocks. Later on the cow drops prostrate. This may be succeeded by a stage of excitement, throwing about of the head and bellowing, but more frequently the cow passes into a semi-conscious sleepy condition and is unable to rise; she remains in this state, moaning slightly and assuming a characteristic posture, with her neck flexed laterally and her nose touching the point of her shoulder.

As the disease progresses the cow becomes comatose, is unable to see, to swallow, or to defecate, tympanitis sets in and death supervenes.

Methods of Prevention and Treatment.

The nature of preventative treatment largely depends on the conditions under which the animals are housed; but the principle involved is always "to bring the animal into a state of health most nearly resembling that of nature."

If the cow is very fat, reduce her condition by diminishing the amount and the richness of the food supplied for a week or so, before and after parturition; this may be assisted by a judicious use of mild purgatives.

If the surroundings are suitable, the cow, for a fortnight before she is due to calve, might be turned out to graze in a field in which the grass is not too abundant and where she would require to move about in search of her sustenance.

Cows coming near the calving should be kept on a cooling, laxative, and somewhat restricted diet, *e.g.*, roots, mashes, treacle. Avoid giving cows, for a couple of weeks before calving, much dry food, and especially chaff and "light" corn.

It may be pointed out that the application of preventative methods is of special importance before the second, and especially the third, calving; heifers and old cows being less subject to attack.

In the case of cows which might be considered as pre-disposed to the disease, there is reason to believe that the iodine injection mentioned below, used as a preventative immediately after calving, would be attended by good results.

When the symptoms are recognised, a veterinary surgeon should at once be called in. Meanwhile, until he arrives, a simple enema should be given and a good dose of Epsom salts, and the animal might be supplied with a comfortable bed.

The methods of treatment adopted to combat this disease have been many and various and the success which has attended these methods has, to say the least of it, been disappointing. However, within the last few years a Danish veterinarian has been successful in introducing a special treatment, which has stood a lengthened test and been attended with results that compare favourably with all others, and which appears worth trying generally. The treatment referred to is the injection through the teats into the mammary gland of a solution whose basis is a preparation of iodine, followed by a further introduction of an abundant supply of air, the operation being supplemented by careful and judicious massage of the udder. By this method the percentage of recoveries has been much increased, and if promptly and properly applied as atisfactory result in quite 80 per cent. of the cases treated may be expected.

As the application of this treatment requires special knowledge and skill with delicate manipulation, is it not advisable that any but a skilled veterinary surgeon should undertake it; but under such conditions it should certainly be adopted.—[Leaflet 96, from Board of Agriculture, England].

BY-PRODUCTS OF THE GRAPE.

The California Product Company's establishment has always been a kind of puzzle. Extensive and substantial buildings were erected, but the management maintained the strictest secrecy as to its operations, and everywhere were notices to keep out. At last the company is prepared to let the public know a little of what it is doing, or rather what is proposed to do, for the work thus far has been largely experimental. While the utilisation of waste products in the United States is an important industry, the manner and method of obtaining the by-products of the grape were new problems to be solved after extensive experimentation. The experimental stage has now been gone through, and the company has all

its formulas protected. It now proposes to begin on a commercial basis, and the industry promises to be a very important one for this country.

George W. Hooven, the president of the company, stated he had a number of samples of various by-products made from the waste of packing-houses and wineries. In a pamphlet, which he has just issued, he describes what it is proposed to manufacture, as follows:—

"The great fruit-growing state of California at this time presents a most inviting field for operators with sufficient technical knowledge and capital to utilise the by-products or waste materials obtainable from its fruit packing and seeding plants and its wineries.

"In 1902 the Californian grape crop yielded 96,000,000 pounds of raisins and 40,000,000 gallons of wine. In the single county of Fresno, the grape crop of 1900 realised \$4,429,000 (£885,800). These grapes were made into wine or raisins, and the larger part of the raisins were seeded. If the utilisation of the waste from this crop produced values proportionately as great as came from the packing-houses or the degreasing of wool—and such results are quite feasible—it would mean over \$500,000 (£100,000) worth of by-products from the waste of one year's grape crop of the country.

"The California Product plant receives annually from the raisin seeding and packing companies thousands of tons of grape seeds and other waste, from which it manufactures alcohol, and from which it will manufacture an oil similar to olive oil, suitable for table purposes, and now used in Europe. This also has the properties of a drying oil, and can be used as a substitute for linseed oil. It will saponify, and can be used in the manufacture of fine toilet soaps. From the residuum, tannin extract will be manufactured, and disposed of in the tanneries for the treatment of leather. After these products are taken out, there remains a fine chocolate-like meal that is excellent cattle food.

"This plant also receives from the large wineries thousands of tons of pomace, or more, that are left after making wine from the grapes. This material is dried, and the seeds separated and put to the same use as the raisin seeds. The pulp and skins yield cream of tartar and tartaric acid. The process of drying produces from 50 to 60 per cent. of the weight of the pomace in a vapour, which will be condensed to yield acetic acid, of which it contains from 5 to 10 per cent. Various commercial acetates will be produced from the same source. They are regarded as very valuable products. The residuum will be submitted to destructive distillation to yield vegetable black, known as 'Frankfort black,' and crude pyroligneous acid and its products, the same as are produced in the manufacture of charcoal.

"Even the grape stems will be utilised. When shredded they have the appearance and character of hemp or jute fibre, and they

undoubtedly form a basis for a very fine paper stock; and in this connection we would draw attention to the many attempts and final success in finding a process for converting the black, useless hulls of cotton seed into a valuable paper stock.

"The United States secures most of its present supply of tartar from France, Italy, and Germany, the importations amounting to about $3,000,000 (£600,000) annually, all manufactured from the waste and argols obtained from wineries.

"The pomace or waste obtainable from the wineries in California is richer in tartar than the same material obtainable from the wineries in Europe. This is due to the large amount of potash in the soil of California. Even the seeds in the California grape are larger and more numerous than the seeds obtained from the European grape. This is a local advantage, paralleled in the cotton-seed industry, for the seed of American cotton is larger than that in the cotton of Egypt and India."

ADVICE ABOUT ROUP.

Remember, just one crack or knot-hole near the roosts may entail roup. It's easier and much cheaper to prevent roup than to cure it. This timely advice doesn't mean, as some extremists seem to think it should, no ventilation at all. We believe in ventilation even in the winter time. But give ventilation—that is, admit fresh air—yet at the same time avoid draughts as you would the evil one.

If, however, it is too late to prevent roup, if the disease has already been contracted and obtained a foothold, how to treat it becomes also a timely question. It is nonsense to say that it never pays to doctor sick fowls. Roupy birds are frequently suffering from a severe cold. Cure them and they are as valuable as ever; but never breed from a bird while it is affected by the roup. Cure it first. If you can't cure it, kill it; but try to cure it if it is worth the effort; and usually, after all the time and expense of getting a bird up from the egg to maturity, it really doesn't pay to let it die with the roup.

Begin treatment for roup by checking its spread through the flock. This can be done by thoroughly cleaning the henhouse and fumigating it by burning sulphur. Then separate the sick fowls from the well ones. Put all the patients in a little hen hospital by themselves. The food for the sick birds should be of a warm, stimulating nature—hot bran and meal mashes, with plenty of red pepper and ginger, and a little meat to make it appetising. Swollen faces and sore eyes and nostrils may be cleansed and healed

by a wash of hot salt and vinegar or sulphate of zinc and tincture of myrrh, equal parts. A pill of mustard and butter will often be highly beneficial, or perhaps one of the many roup cures may be worth much more than it costs to you if your birds have the roup; but prevent it if you can; cure it if you can; and, above all, don't charge it to the climate of the Pacific Coast, for poultry and roup go together all over the world if the poultry is mismanaged or exposed to the disease.—*Exchange.*

GRADING AND PACKING FRUIT AND VEGETABLES.

Intensive cultivation has been carried in many places to a high pitch of excellence, and British horticulturists pride themselves, justly, upon their skill as producers. Admirable and necessary as the highest cultivation must always be, yet something more is required to insure complete commercial success, namely, the conveyance of the produce in the best possible style to the market or to the consumer. It is at this point too many fail, and a material proportion of unprofitable sales is mainly attributable to neglect in presenting goods in the most satisfactory manner. Proofs of this defect are evident in every British market, and commonly the produce of the home grower may be seen in direct contrast with that of his foreign competitors, to the conspicuous disadvantage of the former. It is the purpose of the following notes to give some directions that, with the exercise of intelligence in carrying them out, may assist in improving the selling value of both fruits and vegetables as produced in this country.

To aid in grading fruits to the best advantage, it must be assumed that the preliminaries of successful cultivation have received due attention. The selection of the best varieties, suitable sites and soils, with every possible care in protecting the trees from attacks of insects and diseases, demand the cultivator's utmost skill and unceasing watchfulness. Finally, in preparing for the actual work of grading, the method and time of gathering should receive the strictest attention, or much of the other labour will be reduced in value. It is not sufficiently recognised how readily all fruits are injured by rough handling. Even hard, unripe apples and pears are soon bruised, and not only do these marks show as serious defects in the appearance of the fruits, but the keeping qualities are also affected.

One general rule is applicable to all fruits, and that is, they should never, if it can be avoided, be gathered when they are wet, especially if they have to be packed for sending a long distance.

In perparation for sorting, the fruits should be taken and carefully spread on a table or bench, which may slightly slope to the fruit, and should be of a convenient height for the packer to stand at. The soft fruits must be conveyed to the sorting room in shallow trays or baskets, so that they can be graded direct without turning them out. When experienced hands are employed some degree of sorting can be done at the time of gathering, thus saving further handling or removal of the fruits, and the grower will in every case endeavour to reduce this to the minimum.

Several matters have to be considered in the actual work of grading, and an intimate knowledge of the characteristics of varieties is essential to the best results. The effects of seasons on large crops also demand attention; for the second grade of one crop might rank as the first of another. It is impossible to lay down a rule that would constitute a standard equally reliable under all conditions, but a general idea can be given of the relative values of different grades under similar circumstances.

The points of importance in classifying the best fruits are :—

(1.) Freedom from injuries and blemishes. (2.) Good size and even form. (3.) Colour. (4.) High quality with ripeness.

The first two are essential to all high-class fruits, and no defective, distorted, or undersized samples should be allowed in the leading grades of any kind.

The third quality is a special one, which always possesses a marked value in fruits for dessert, and even amongst some used for cooking or preserving, as in apples, red currants, raspberries, and strawberries, for example. A richly-coloured sample, though only of moderate size, if free from defects, will often possess a higher market value than larger and duller fruits. Cox's Orange Pippin, for instance, if sold in two grades, one large and dull or greenish-yellow, and the other a size smaller, but in its best colour will command the larger price for the latter; and this is true of many other fruits where colour is a characteristic that is sometimes deficient in the larger sizes.

As regards the fourth point, mere size may also be a secondary consideration, provided the fruits are choice, in perfect condition for immediate use, and free from defects. This especially concerns small packages of dessert fruits, such as the finest pears, plums of the greengage type, ripe cherries, peaches, and nectarines. A special market must be at command for such samples, or they should be sent direct to the consumers or retailers.

(To be continued.)

GARDEN NOTES FOR MARCH.

By PERCY G. WICKEN.

By the time these notes appear in print the worst of the hot weather should be over, and, although there may be no immediate prospect of rain, advantage should be taken of every opportunity to get the garden cleaned up, and get everything in order for sowing at an early date. All rubbish should be buried; it is better if it can all be gathered together and allowed to rot before being dug into the ground; if stacked in a heap and well moistened it will soon rot, and is then ready for use. All ground not in use should be turned over as soon as possible, so as to allow the sun to have access to as much of the soil as possible, and the deeper the digging can be done the better. If subsoiling to a depth of two feet can be carried out it will prove an advantage. The subsoil need not be brought to the surface, but just broken up under the part dug, this will enable the ground to hold a much greater supply of moisture and also enable the roots to penetrate deeper into the soil. Plants at this time of the year wilt up during the hot part of the day; this wilting is caused by the water evaporating from the leaves faster than the plant can pump it up from the soil. Soon after sundown the plant resumes its normal condition; deep working of the soil will to a great extent prevent this, as the roots penetrating deeper into the soil enable them to supply a much greater quantity of moisture to the plant. The principal work of the month is to keep the cultivators going among the growing crops, and to pay attention to the saving of seed for future use. In selecting plants, melons, pumpkins, etc., for seed purposes care should be taken to see that the plants are true to name, and they should be allowed to fully ripen before taking the seed. The seed should be thoroughly dried before putting away, otherwise it is likely to heat and the germinating power is lost.

ASPARAGUS.—A bed of sufficient size should be prepared in good time for planting early in the season. It should be trenched 2ft. deep, keeping the surface soil on the top. Dig in while trenching a liberal supply of well rotted farm yard manure and mix well with the soil. The soil should be left in a rough condition as it will then have a good chance of mellowing by planting time.

BEANS (French).—Except in a few of the warmer localities, this crop will be nearly over. In hot parts, where there is no danger of frost, a few rows may be sown.

BEANS (Broad).—This vegetable likes a heavy clay loam soil, although it will grow and bear in most soils. It should not be sown before the end of the month, and the ground requires to be well broken up, and if poor apply plenty of stable manure. Do not

apply nitrogenous manures. Bonedust, superphosphate, and potash are the manures which should be used. Sow in rows 3ft. apart and about 5 inches in the rows.

Beet (Red).—A few rows may be sown. Thin out the plants that are coming up from previous sowings.

Borecole or Kale.—This is a plant which some like as a vegetable, and others do not think it worth growing. Seed may be sown the same as cabbage, and plants put out. It yields a large amount of green stuff, which can be used for the table or for stock.

Cabbage, Cauliflower, and Brussels-sprouts.—Plenty of plants should be available from the seed beds, and they should be planted out as soon as the ground is moist enough. Plant in rows 3ft. apart and 2ft. in the rows.

Carrots.—Sow for the winter. The drills should be 18in. apart. The seed takes some time to come up, and the weeds want looking after.

Lettuce.—Sow a little seed to have a few plants handy for planting out when required; for garden use it is better to plant out only a few plants at a time and have them fresh than to plant a number at one time and perhaps have them wasted.

Melons and Pumpkins.—Store away for future use all those that are sound, they will be useful later on; any dry shed will do to store them in.

Sweet Potatoes should now be ready to dig. They can be stored, and if kept in dry sand will keep good throughout the winter.

Tomatoes are getting scarce; destroy by burning or boiling all diseased fruits, to prevent the spread of disease.

Peas.—In the cooler districts a few rows of peas may be sown. Work the ground well, and apply plenty of potash and manures.

Turnips.—Prepare as much land as you require for this crop, and as soon as the rain comes sow full crops. There are a great number of varieties to choose from in both white, yellow, and Swede varieties.

Farm.—The crops being now all under cover, and the bulk of the wheat crop either sent to market or stored until the grower cares to sell, leaves the settler with more time on his hands. Before putting his harvesting machinery away, however, he should take care to thoroughly clean all parts of the machines and to give them a good coating of oil or grease. Exposure to the weather and putting away in a dirty, rusty condition do more to deteriorate a machine than the actual work done.

RAINFALL FOR THE YEAR 1903.

The accompanying table shows the rainfall for last year at every station in the State from which returns have been received.

At a few the records are still incomplete and totals for 10 and 11 months are given, as stated in the footnote.

The winter season started late, and did not fairly set in throughout agricultural districts till 31st May. June was a good month. The early part of July was very fine, but from the 15th we had a month of exceptionally wintry weather. September again was remarkably wet, in fact the wettest on record.

October was also a good month. So that although the season started badly it finished unusually well, and the year's total generally was above the average.

Glancing at the figures in the accompanying table and comparing them with the averages for previous years, we find that in East Kimberley the fall was remarkably heavy, more than double the average; in the Western portion of the tropics, *i.e.*, on the North-West coast and throughout the Pilbarra districts, it was remarkably light, being less than half the average in the latter case. On the West coast, from the North-West Cape Southwards, and throughout the South-West division, it was above the normal. On the Murchison it was generally deficient, and on the Coolgardie Fields and South coast it was variable, being sometimes a little above and sometimes rather below the average for previous years. The fall was distributed amongst the individual months as follows:—

January.—Very light, except in the Kimberley district, where very heavy floods occurred. Wyndham recorded 25·07 inches in five consecutive days.

February.—Mostly light except throughout the goldfields and North-West, where it was about normal. Some places in the tropics received a very heavy downpour.

March.—Mostly very light. About normal on the South coast. Very patchy in the tropics.

April.—Patchy. Rather above the average in the South-West and South, including the Coolgardie Fields; about normal in the Murchison and North-West; and heavy in the Kimberley district.

May.—Very light in agricultural areas, but general rain set in on the 31st. Heavy throughout the Coolgardie, Murchison, and Gascoyne districts. Practically *nil* in the tropics.

June.—About or above the average throughout the State South of the tropics.

July.—Dry during the first half, but raining almost continuously from the 15th to the 31st in South-West and South districts. On the whole about normal.

August.—Very wet month throughout the agricultural districts, especially between the 1st and the 15th. Normal on the fields.

September.—Very wet throughout the South-West division, the rainfall being the heaviest on record for September; about normal on the goldfields, and slightly above average on South coast.

October.—A good fall in the agricultural districts; slightly above average on the fields.

November.—Generally below normal.

December.—Fairly normal on the whole, but heavy in the extreme North-East and on the Eastern Goldfields.

RAINFALL for the Year 1903.

(Completed as far as possible.)

Stations.	No. of points. 100 = in.	No. of wet days.	Stations.	No. of points. 100 = in.	No. of wet days.
East Kimberley:			North-West—*contd.*		
Wyndham	5,325	76	Roy Hill	748	20
The Stud Station *b* ...	3,791	34	Mosquito Creek *b* ...	340	12
Carlton *b*	4,243	39	Mulga Downs ...	705	19
Rosewood Downs *b* ...	2,743	38	Woodstock *a*	522	—
Argyle Downs *b* ...	3,087	41	Mt. Florence... ...	1,547	19
Lisadell *b*	4,105	34	Tambray	2,175	30
Turkey Creek ...	5,041	—	Millstream	1,395	18
Hall's Creek	4,202	—	Yandyarra *a*	1,159	11
Flora Valley *b* ...	1,988	39	Mallina *b*	1,174	14
Ruby Plains *b* ...	1,884	38	Whim Creek	1,852	16
Denison Downs ...	2,407	—	Cooyapooya *a* ...	1,007	6
			Woodbrooke	1,041	9
West Kimberley:			Croydon	2,301	25
Obagama *a*	2,404	39	Balla Balla	1,075	9
Beagle Bay *b* ...	2,203	44	Roebourne	884	11
Derby	2,550	48	Cossack	968	13
Yeeda *a*	1,701	30	Fortescue	555	9
Mt. Anderson *b* ...	1,842	30	Mardie	459	9
Leopold Downs *a* ...	2,500	36	Mt. Stewart	1,636	26
Fitzroy Crossing ...	3,002	52	Yarraloola *a*	490	12
Fitzroy (C. Blythe) *a*	1,779	23	Chinginarra	580	7
Quanbun *b*	2,082	27	Onslow	635	16
Broome	1,915	31	Peedamullah	792	29
Roebuck Downs ...	1,768	36	Red Hill	986	19
Thangoo	1,126	31	Mt. Mortimer *a* ...	1,085	20
La Grange Bay ...	1,352	34	Wogoola *b*	1,247	21
			Nanutarra	777	—
North-West:			Yanrey	562	20
Wallal	762	14	Point Cloates *a* ...	734	20
Condon	925	9			
DeGrey River ...	972	9	Gascoyne:		
Port Hedland ...	909	17	Winning Pool ...	1,165	23
Boodarie	1,008	11	Towara	658	27
Warralong	1,024	21	Ullawarra *a*	651	13
Muccan	846	21	Maroonah	755	—
Ettrick	923	19	Gifford Creek *b* ...	753	12
Mulgie	703	18	Bangemall *a*	746	18
Eel Creek	613	—	Mt. Augustus *b* ...	925	15
Pilbarra	1,326	20	Minnie Creek ...	656	24
Coongon *a*	817	15	Yanyeareddy... ...	1,212	20
Pardoo *b*	800	—	Williambury... ...	744	30
Warrawagine ...	781	18	Wandagee	608	17
Bamboo Creek ...	569	19	Bernier Island ...	1,054	40
Marble Bar	830	31	Boolathana	823	28
Warrawoona	834	21	Carnarvon	1,234	25
Corunna Downs ...	545	24	Doorawarrah... ...	672	20
Nullagine	863	28	Mungarrah	471	19
Kerdiadary	700	24	Clifton Downs ...	386	9

a 11 months only. *b* 10 months only. — Signifies "no record."

RAINFALL FOR THE YEAR 1903—*continued.*

STATIONS.	No. of points. 100 = in.	No. of wet days.	STATIONS.	No. of points. 100 = in.	No. of wet days.
GASCOYNE—*contd.*			GASCOYNE—*contd.*		
Dairy Creek *a* ...	457	17	Gabyon	830	29
Upper Clifton Downs *b*	555	23	Wuraga	779	26
Errivilla *b*	682	16	Gullewa	964	37
Dirk Hartog Island...	1,141	54			
Sharks Bay	1,249	—	SOUTH-WEST DIVISION (NORTHERN PART):		
Kararang *b*	1,182	40			
Meedo *a*	826	39			
Tamala	1,357	47	Murchison House *a* ...	1,620	60
Wooramel	1,159	36	Mt. View	1,095	32
Hamelin Pool ...	763	37	Mumby	2,016	77
Byro	616	22	Northampton ...	2,202	62
Yarra Yarra	740	22	Mt. Erin *b*	2,097	59
Berringarra	508	23	Oakabella *b*	2,570	71
Mt. Gould *a*	589	19	Tibradden	2,171	70
Moorarie *a*	719	19	Sand Springs ...	1,878	55
Wandary	712	24	Mullewa	1,505	65
Peak Hill	561	25	Kockatea	1,600	57
Horseshoe	785	30	Geraldton	2,419	90
Mt. Frazer *b*	719	17	Greenough	2,853	65
Abbotts	838	25	Dongara	2,310	72
Belele	700	20	Dongara (Pearse) *a* ...	2,169	69
Mileura	695	23	Mingenew	1,820	90
Milly Milly	455	23	Urella	1,504	65
Manfred	627	29	Rothesay *a*	1,082	39
New Forest *a* ...	745	28	Field's Find	901	—
Woogorong	646	24	Carnamah	1,749	77
Boolardy	551	15	Watheroo	1,915	93
Twin Peaks *a* ...	605	26	Dandaragan	2,553	95
Billabalong *a*... ...	585	18	Moora	2,251	80
Wooleane	622	23	Yatheroo	2,528	82
Murgoo *b*	679	24	Walebing	2,362	97
Meka	667	33	New Norcia	2,133	93
Mt. Wittenoom ...	698	33			
Nannine	589	28	SOUTH-WEST DIVISION CENTRAL (COASTAL):		
Star of the East ...	670	27			
Annean	681	30	Gingin	3,715	102
Tuckanarra *b* ...	588	36	Belvoir	3,211	100
Coodardy	447	29	Mundaring	4,400	115
Cue	596	42	Guildford	3,683	126
Day Dawn	595	41	Canning Waterworks	3,325	98
Lake Austin	679	34	Perth Gardens ...	3,545	139
Lennonville	891	47	„ Observatory ...	3,569	140
Mt. Magnet	821	36	Subiaco	3,388	129
Challa	677	30	Claremont *b*	3,103	96
Youeragabbie ...	642	—	Fremantle	3,302	135
Murrum *a*	648	16	Rottnest	2,899	33
Burnerbinmah ...	708	38	Armadale *a*	3,553	96
Barnong	1,127	43	Rockingham	3,569	111
Yalgoo	716	40	Canning River ...	4,600	95

a 11 months only. *b* 10 months only. — Signifies "no record."

RAINFALL FOR THE YEAR 1903—*continued.*

Stations.	No. of points. 100 = in.	No. of wet days.
South-West Division, Central (Coastal)—*contd.*		
Jarrahdale	4,896	107
Mandurah	3,646	111
Pinjarra	4,476	113
Yarloop	4,237	136
Harvey *a*	4,005	115
South-West, Central Part (Inland):		
Hatherley *b*	1,420	72
Momberkine	1,460	63
Monglin	1,748	86
Newcastle	2,041	71
Eumalga	2,322	96
Northam	1,788	76
Grass Valley	1,713	76
Meckering	1,341	83
Codg-Codgin	1,215	102
Yarragin	1,392	79
Doongin	1,283	67
Cuttening	1,306	88
Whitehaven	1,511	102
Sunset Hills	1,682	76
Cobham	2,025	107
York	1,693	100
Beverley	1,578	79
Barrington	1,449	85
Stock Hill	1,780	74
Sunning Hill... ...	1,838	76
Wandering	2,904	99
Pingelly	1,944	71
Marradong	3,075	93
Bannister	3,091	111
Narrogin	2,046	99
Wickepin	2,014	95
Gillimaning	1,698	98
Bunking	2,813	68
Bullock Hills... ..	1,922	86
South-West Division (Southern Part):		
Bunbury	4,427	120
Collie	3,775	144
Glen Mervyn... ...	4,056	117
Dardanup *a*	3,823	100
Donnybrook	3,729	119
South-West Division (Southern Part—*contd.*		
Boyanup	3,989	117
Ferndale *a*	3,900	122
Busselton	3,089	135
Quindalup	3,544	130
Lower Blackwood ...	5,519	153
Karridale	4,134	190
Cape Leeuwin ...	2,938	187
Biddellia	4,650	156
The Warren	5,264	155
Lake Muir	3,241	155
Mordalup	2,849	150
Deeside	3,192	156
Riverside	3,270	152
Balbarup	3,802	134
Wilgarup	3,798	155
Bridgetown	3,698	166
Westbourne	3,272	—
Greenbushes *a* ...	3,308	74
Greenfields	3,496	113
Glenorchy	2,897	98
Williams	2,377	116
Arthur	2,174	79
Darkan *a*	2,604	67
Wagin	2,338	86
Glencove	2,494	100
Dyliabing	2,138	109
Katanning	2,431	114
Kojonup	3,547	124
Broomehill	3,518	109
Sunnyside *a*	2,108	105
Woodyarrup	2,565	104
Cranbrook *b*	2,252	104
Blackwattle	2,625	107
Mt. Barker	3,206	161
Kendenup	2,812	138
St. Werburgh's ...	2,911	167
Forest Hill	3,686	187
Denmark	4,659	146
Grasmere	4,188	178
Albany	4,044	186
Point King	3,879	138
Breaksea	2,362	196
Wattle Hill	3,972	—
Cape Riche	2,125	102
Pallinup	2,169	105
Bremer Bay	2,670	122
Jarramongup *a* ...	2,047	76

a 11 months only. *b* 10 months only. — Signifies "no record."

RAINFALL FOR THE YEAR 1903—*continued.*

Stations.	No. of points. 100 = in.	No. of wet days.
Eastern Division:		
Lake Way	737	44
Gum Creek	743	22
Mt. Sir Samuel ...	893	37
Lawlers	1,015	53
Leinster G.M. ...	964	40
Lake Darlôt	725	28
Mt. Leonora	871	43
Mt. Malcolm	972	—
Mt. Morgan	828	35
Burtville	698	15
Laverton	871	25
Murrin Murrin ...	990	42
The Granites	930	37
Tampa	1,002	25
Kookynie	1,257	40
Niagara	1,184	36
Yerilla	1,192	33
Edjudina	1,311	41
Menzies	1,500	53
Mulline	1,331	40
Waverley	1,477	50
Goongarrie	1,219	44
Mulwarrie	1,254	53
Bardoc	1,146	—
Kurawa	1,395	58
Kurnalpi	1,195	51
Bulong	998	60
Kanowna	1,251	60
Kalgoorlie	1,225	55
Coolgardie	978	58
Burbanks P.O. ...	1,053	57
Woolubah *b*	1,148	61
Widgemooltha ...	941	66
50-Mile Tank... ...	926	56
Waterdale	825	54
Norseman	877	56
Bulla Bulling ...	913	49
Woolgangie *a* ...	803	42
Boondi	815	—
Eastern Division—*contd.*		
Boorabbin	995	67
Koorarawalyee ...	1,104	—
Karalee	1,115	47
Yellowdine	1,088	47
Southern Cross ...	902	65
Parker's Road ...	959	—
Mt. Jackson	1,100	37
Bodallin	993	42
Burracoppin	1,095	—
Kellerberrin	1,217	73
Meredin	981	—
Mangowine	1,192	—
Wattoning *a*	1,015	37
Eucla Division:		
Ravensthorpe ...	1,360	104
Coconarup	1,281	111
Hopetoun	1,793	111
Fanny's Cove ...	2,433	75
Park Farm	2,357	134
Esperance	2,497	147
Gibson's Soak ...	2,021	123
30-Mile Condenser ...	1,746	105
Swan Lagoon ...	1,270	124
Grass Patch	1,313	119
Myrup	2,672	134
Lynburn	2,373	102
Boyatup	2,759	115
Point Malcolm ...	1,930	126
Israelite Bay ...	1,297	95
Bulbinia	1,187	92
Frazer Range ...	1,066	65
Balladonia	905	74
Southern Hills ...	1,113	48
Eyre	1,322	95
Mundrabillia *b* ...	1,283	53
Eucla	1,059	97

a 11 months only. *b* 10 months only. — Signifies "no record."

W. E. COOKE,
Government Astronomer

The Observatory, Perth,
27th January, 1904.

THE CLIMATE OF WESTERN AUSTRALIA DURING JANUARY, 1904.

The principal meteorological feature of the month was the heavy rain in the Kimberley district, more especially between the 17th and 22nd, when a monsoonal "low" existed near the North-West coast, combined with a well established "high" along our South coast. This combination also caused great heat all down the West coast from Cossack to Geraldton. The total rainfall was far above the average for previous years in the Kimberley district, especially at Derby, where 17·52 inches were recorded. Elsewhere it was light, and in most places only a few showers fell.

The pressure on the whole was about normal, as was also the temperature, except all along the West coast, from Cossack to the Leeuwin. The hottest place was Marble Bar, where the mean of the daily maxima was 107·7, and the mean of the nightly minima 79·9. The highest temperature recorded for the month was 114·0 at Onslow.

Perth compares very badly with Eastern capitals this month. As a rule the Adelaide daily mean maximum is 2·7 higher than ours, but last January was hotter than usual here, and exceptionally cool and wet in Adelaide, and our mean maximum was 5·2 higher than theirs. It was also exceptional cool and wet in Melbourne, and their mean maximum was only 74·9, or 11·6 below ours. It is however satisfactory to note that along our South coast are places which compare very favourably even with Melbourne. At Albany, where the temperature was rather above normal, it was still 1·2 below that for Melbourne, and at Breaksea it was 4·6 below.

The Climate of Western Australia during January, 1904.

	Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Barometer: Average for previous years.	Barometer: Highest for Month.	Barometer: Lowest for Month.	Shade Temperatures. January, 1904. Mean Max.	January, 1904. Mean Min.	January, 1904. Mean of Month.	January, 1904. Highest Max.	January, 1904. Lowest Min.	*Average for previous Six Years. Mean Max.	*Average: Mean Min.	*Average: Highest ever recorded.	*Average: Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Rainfall. Total Points since Jan. 1.
North-West and North Coast:	Wyndham ...	...	29·761	...	...	...	...	...	...	...	97·8	79·9	111·8	69·0	...	...
	Derby	29·726	29·792	29·857	29·611	93·9	78·1	86·0	105·2	73·8	97 1	78·4	107·0	70·2	1752	1752
	Broome ...	29·725	29·767	29·841	29·590	93·0	79·4	86·2	102·8	72·0	92·8	79·0	104·5	68·0	754	754
	Condon ...	29·728	29·772	29·861	29·597	95·0	77·7	86·4	103·0	66·0	95·0	76·2	106·5	65·0	117	117
	Cossack ...	29·740	29·760	29·878	29·591	100·0	79·0	89·5	110·0	72·0	99·4	78·2	113·4	71·8	227	227
	Onslow ...	29·750	29·769	29·920	29·630	99·0	75·0	87·0	114·0	69·0	97·3	73·4	117·0	63·8		3
	Carnarvon ...	29·793	29·826	30·00	29·655	92·7	73·6	83·2	112·0	64·8	88·9	69·7	113·0	58·2	3	3
	Hamelin Pool...	29·785	29·826	30·030	29·580	101·0	71·0	86·0	112·0	61·0	98·2	68·2	112·0	51·4	*Nil*	*Nil*
	Geraldton ...	29·865	29·902	30·120	29·600	90·0	65·0	77·5	107·0	59·0	82·9	64·1	111·0	51·0	*Nil*	*Nil*
Inland:	Hall's Creek *	...	29·792	...	...	...	...	...	...	...	99·9	72·8	110·0	50·0	...	...
	Marble Bar ...	...	...	...	...	107·7	79·9	93·8	113·0	74·0	...	...	...	...	109	109
	Nullagine * ...	29·720	29·747	29·887	29·566	103·4	75·1	89·2	108·0	63·0	101·4	74·5	112·0	63·8	163	163
	Peak Hill ...	29·745	29·757	29·960	29·580	100·0	76·0	88·0	106·0	67·0	98·6	73·4	111·2	58·6	7	7
	Wiluna ...	29·759	...	30·006	29·554	98·8	71·4	85·1	106·2	59·0	...	...	...	...	*Nil*	*Nil*
	Cue	29·815	29·806	30·010	29·610	102·0	75·9	89·0	110·2	61·1	100·7	72·6	114·0	54·8	*Nil*	*Nil*
	Yalgoo ...	29·801	29·818	30·002	29·623	98·8	71·0	84·9	107·0	58·0	99·1	68·5	114·0	54·0	*Nil*	*Nil*
	Lawlers ...	29·817	29·824	30·117	29·573	97·0	70·4	83·7	108·2	61·2	96·0	71·3	112·7	53·1	9	9
	Laverton ...	29·859	...	30·169	29·566	94·9	67·0	81·0	108·2	54·6	...	...	...	...	15	15
	Menzies ...	29·858	29·854	30·178	29·538	94·4	65·6	80·0	108·0	52·6	94·4	67·5	113·2	48·0	2	2
	Kanowna ...	...	...	...	...	92·3	60·7	76·5	108·0	49·8	...	...	...	...	*Nil*	*Nil*
	Kalgoorlie ...	29·892	29·899	30·229	29·494	92·3	61·8	77·0	108·0	50·3	92·4	63·8	112·4	47·1	4	4
	Coolgardie ...	29·855	29·892	30·210	29·500	92·0	60·0	76·0	107·0	49·0	92·2	62·1	112·2	46·0	1	1
	Southern Cross	29·935	29·874	30·070	29·450	94·4	62·1	78·2	107·0	48·0	94·2	62·4	113·0	44·0	14	14
	Walebing ...	...	...	...	...	92·2	61·8	77·0	104·0	49·0	...	...	...	...	*Nil*	*Nil*
	Northam ...	...	...	...	...	93·2	59·8	76·5	104·5	51·0	...	...	...	...	*Nil*	*Nil*
	York	29·935	29·918	30·310	29·540	90·8	59·9	75·4	104·0	50·4	93·3	60·8	111·0	45·5	1	1
	Guildford ...	...	...	...	...	91·5	62·1	76·8	106·8	53·0	...	...	...	...	9	9

* For the first time means of previous years are taken between 1897 (when the Meteorological Service was re-organised) and 1902 (inclusive). All observations prior to 1897 have been rejected, except in the case of the Perth Botanical Gardens.

The Climate of Western Australia during January, 1904—*continued*.

Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Shade Temperatures. January, 1904. Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	*Average for previous Six Years. Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Total Points since Jan. 1
South-West and South Coast:															
Perth Gardens ...	29·924	29·936	29·175	29·566	89·5	63·9	76·7	104·8	56·0	87·7	62·5	116·7	46·0	15	15
Perth Observatory	29·938	29·942	29·169	29·572	86·5	63·9	75·2	102·2	55·1	83·9	62·8	107·0	50·6	11	11
Fremantle ...	29·943	29·944	29·174	29·586	83·1	65·0	74·0	100·0	55·5	79·7	63·2	105·0	51·8	15	15
Rottnest ...	29·944	29·924	29·172	29·580	80·6	64·9	72·8	100·0	55·6	76·7	63·6	101·4	52·5	2	2
Mandurah ...	...	...	...	...	86·7	61·9	74·3	101·1	52·0	...	...	...	...	6	6
Wandering ...	...	...	...	...	89·0	53·6	71·3	101·1	45·0	...	...	...	...	15	15
Collie	...	...	...	...	86·6	54·3	70·4	101·5	44·2	...	...	...	...	24	24
Donnybrook ...	...	...	...	...	85·3	57·9	71·6	101·0	47·0	...	...	...	...	38	38
Bunbury ...	29·960	29·973	29·230	29·610	87·5	58·1	72·8	95·5	50·0	81·9	57·9	103·1	43·4	33	33
Busselton ...	...	...	...	...	83·1	55·6	69·4	95·0	46·0	...	...	...	...	11	11
Cape Naturaliste	...	...	...	...	78·0	58·8	68·4	91·0	51·0	...	...	...	...	31	31
Bridgetown ...	...	...	...	...	85·6	50·5	68·0	100·0	35·0	...	...	...	...	33	33
Karridale ...	29·930	30·004	29·180	29·570	77·8	56·9	67·4	99·5	48·8	75·0	56·8	98·0	42·3	58	58
Cape Leeuwin ...	29·965	29·975	29·260	29·550	74·0	62·0	68·0	88·0	54·0	72·8	61·8	91·6	51·0	106	106
Katanning ...	29·960	29·952	29·250	29·570	85·1	53·3	69·2	104·0	45·0	86·4	54·6	106·0	42·0	*Nil*	*Nil*
Albany	30·018	30·003	29·311	29·557	73·7	56·7	65·2	98·8	46·5	72·6	57·0	99·0	42·3	91	91
Breaksea... ...	30·016	29·996	29·320	29·540	70·3	59·4	64·8	91·0	50·8	69·2	59·0	89·8	46·8	49	49
Esperance ...	30·095	29·990	29·430	29·700	76·0	57·0	66·5	103·0	40·0	77·3	59·1	107·0	44·5	22	22
Balladonia ...	29·974	...	29·332	29·540	87·4	55·5	71·4	111·4	45·0	...	...	...	...	*Nil*	*Nil*
Eyre*	29·975	29·978	29·410	29·736	78·0	57·8	67·9	111·4	42·0	77·4	58·6	112·0	41·5	48	48
INTER-STATE.															
Perth	29·938	29·942	29·169	29·572	86·5	63·9	75·2	102·2	55·1	83·9	62·8	107·0	50·6	11	11
Adelaide	29·962	29·937	29·257	29·430	81·3	58·8	70·0	100·3	46·9	86·6	61·7	116·3	45·1	253	253
Melbourne	29·912	29·831	29·246	29·387	74·9	57·0	66·0	94·2	48·1	78·1	56·2	111·2	42·0	568	568
Sydney	30·000	29·928	29·310	29·550	77·0	65·0	71·0	97·0	59·0	78·2	64·8	108·5	51·2	193	193

* For the first time means of previous years are taken between 1897 (when the Meteorological Service was re-organised) and 1902 (inclusive). All observations prior to 1897 have been rejected, except in the case of the Perth Botanical Gardens.

The Observatory, Perth,
February, 1904.

W. E. COOKE,
Government Astronomer.

RAINFALL for December, 1903 (completed as far as possible), and for January, 1904 (principally from Telegraphic Reports).

Stations.	December. No. of points. 100 = 1in.	December. No. of wet days.	January. No. of points. 100 = 1in.	January. No. of wet days.
East Kimberley:				
Wyndham ...	647	17	...	...
6-Mile	965	15	...	...
The Stud Station	...	...	...	...
Carlton	...	...	...	...
Denham	...	...	...	...
Rosewood Downs	...	...	...	...
Argyle Downs ...	...	...	...	...
Lisadell	...	...	...	...
Turkey Creek ...	974	...	..	...
Plympton, St. Mary	...	...	...	...
Hall's Creek ...	816	..	...	...
Flora Valley ...	...	...	...	...
Ruby Plains ...	...	...	...	...
Denison Downs ..	781	...	..	...
West Kimberley:				
Obagama ...	...	...	...	...
Beagle Bay ...	...	...	...	...
Derby	362	12	1752	11
Yeeda	...	...	...	...
Liveringa ...	...	...	...	...
Mt. Anderson ...	...	...	...	...
Leopold Downs...	...	...	...	...
Fitzroy Crossing	1209	14	1151	10
Fitzroy (C. Blythe)	...	...	...	...
Quanbun ...	...	...	...	...
Nookanbah ...	...	...	...	...
Broome	297	7	754	13
Roebuck Downs	445	4	...	...
Thangoo	67	6	...	...
La Grange Bay...	76	3	522	9
North-West:				
Wallal	Nil	...	138	6
Condon	Nil	...	117	6
DeGrey River ...	21	1	...	...
Port Hedland ...	17	2	59	5
Boodarie ...	26	2	...	...
Warralong ...	90	3	...	...
Muccan	101	3	...	...
Ettrick	38	2	.	...
Mulgie	20	2	...	...
Eel Creek ...	33	2	...	...
Pilbarra	147	2	24	3
Coongon	...	...	...	...
North-West—cont.				
Warrawagine ...	30	2	...	...
Bamboo Creek ...	58	2	67	7
Marble Bar ...	173	7	109	6
Warrawoona ...	63	3	54	...
Corunna Downs...	59	3	...	...
Nullagine ...	197	5	163	4
Yandicoogina ...	...	...	...	...
Kerdiadary ...	35	1	...	...
Roy Hill	140	3	...	...
Middle Creek ...	...	...	...	...
Mosquito Creek	...	..	...	...
Mulga Downs ...	28	2	...	...
Woodstock ...	...	..	...	...
Mt. Florence ...	180	4	...	...
Tambrey ...	136	4	...	...
Millstream ...	97	3	...	...
Yandyarra ...	...	...	...	...
Mallina	...	...	...	...
Whim Creek ...	22	1	205	...
Cooyapooya ...	...	...	...	...
Woodbrooke ...	12	1	...	...
Croydon	86	3	...	...
Roebourne ...	Nil	...	80	3
Cossack	1	1	227	3
Fortescue ...	Nil	...	6	...
Mardie	Nil	...	...	...
Mt. Stewart ...	160	5	...	...
Yarraloola ...	...	...	...	...
Chinginarra ...	Nil	...	...	...
Onslow	Nil	...	3	1
Peedamullah ...	66	3	...	...
Red Hill	102	4	...	...
Mt. Mortimer ...	...	...	...	...
Peake Station ...	89	3	...	...
Nanutarra ...	60	1	...	...
Yanrey	45	1	...	...
Point Cloates ...	...	...	...	...
Gascoyne:				
Winning Pool ...	172	1	89	3
Towara	36	3	...	...
Ullawarra ...	...	...	...	...
Maroonah ...	140	2	...	...
Gifford Creek ...	...	...	...	...
Bangemall ...	...	...	...	...
Mt. Augustus ...	...	...	...	...

RAINFALL—*continued.*

Stations.	December. No. of points. 100 = 1in.	December. No. of wet days.	January. No. of points. 100 = 1in.	January. No. of wet days.
GASCOYNE—*contd.*				
Minnie Creek ...	Nil	...	...	...
Yanyeareddy ...	136	2	...	...
Williambury ...	27	2	...	...
Wandagee ...	69	2	...	...
Bernier Island ...	Nil	...	...	...
Carnarvon ...	Nil	...	3	1
Brick House ...	Nil	...	...	...
Doorawarrah ...	17	2	...	...
Mungarra ...	Nil	...	...	...
Clifton Downs ...	Nil	...	...	...
Dairy Creek ...	34	2	...	...
Dirk Hartog Is'nd	Nil	...	...	...
Sharks Bay ...	44	1	Nil	...
Kararang ...	Nil	...	...	...
Tamala	Nil	...	...	...
Wooramel ...	69	1	Nil	...
Hamelin Pool ...	Nil	...	Nil	...
Byro	Nil	...	...	...
Yarra Yarra ...	Nil	...	...	...
Berringarra ...	1	1	...	...
Mt. Gould ...	108	4	...	...
Moorarie ...	35	1	...	...
Wandary... ...	30	1	...	...
Peak Hill ...	17	1	7	1
Horseshoe ...	145	2	6	1
Abbotts	Nil	...	4	1
Belele	Nil	...	...	...
Mileura	107	2	...	...
Milly Milly ...	8	1	...	...
Manfred ...	Nil	...	...	...
Woogorong ...	Nil	...	...	...
Boolardy... ...	Nil	...	...	...
Twin Peaks ...	39	3	...	...
Billabalong ...	Nil	...	...	...
Wooleane ...	18	1	...	...
Meeka	30	1	17	1
Mt. Wittenoom ...	35	1	...	...
Nannine	38	3	Nil	...
Star of the East...	40	3	Nil	...
Annean	59	4	8	2
Coodardy ...	26	3	...	...
Cue	31	4	Nil	...
Day Dawn ...	51	4	3	1
Lake Austin ...	30	3	Nil	...
Lennonville ...	49	3	31	2
Mt. Magnet ...	48	3	1	1
Challa	82	3	Nil	...
Youeragabbie ...	79	2	...	...

Stations.	December. No. of points. 100 = 1in.	December. No. of wet days.	January. No. of points. 100 = 1in.	January. No. of wet days.
GASCOYNE—*contd.*				
Burnerbinmah ...	36	1	..	...
Mellinbye ...	81	3	Nil	...
Barnong... ...	22	1	Nil	...
Yalgoo	8	1	Nil	...
Wagga Wagga ...	20	3	Nil	...
Gabyon	74	3	Nil	...
Winarga... ...	61	1	...	...
Gullewa	12	1	Nil	...
SOUTH-WEST DIVISION (NORTHERN PART):				
Murchison House	...	...	...	...
Mount View ...	Nil	...	Nil	...
Mumby	16	1	Nil	...
Northampton ...	Nil	...	Nil	...
Mt. Erin ...	...	...	...	...
Oakabella ...	...	...	...	...
Narra Tarra ...	...	...	Nil	...
Tibradden ...	33	2	...	...
Sand Springs ...	6	1	...	...
Mullewa... ...	66	4	Nil	...
Kockatea ...	37	2	...	...
Bootenal ...	...	...	...	...
Geraldton ...	Nil	...	Nil	...
Greenough ...	Nil	...	Nil	...
Dongara ...	6	1	Nil	...
Dongara (Pearse)	...	...	...	...
Mingenew ...	36	6	Nil	...
Urella	42	2	Nil	...
Yandenooka ...	...	...	...	...
Rothesay ...	...	...	...	...
Field's Find ...	35	5	...	...
Carnamah ...	43	2	Nil	...
Watheroo ...	21	2	Nil	...
Dandaragan ...	Nil	...	Nil	...
Moora	2	2	Nil	...
Yatheroo ...	19	1	...	...
Walebing ...	6	2	Nil	...
New Norcia ...	15	1	Nil	...
SOUTH-WESTERN DIVISION, CENTRAL (COASTAL):				
Gingin	12	1	Nil	...
Belvoir	11	3	1	1
Mundaring ...	33	3	6	1
Guildford ...	27	3	9	2

RAINFALL—*continued.*

Stations.	December. No. of points. 100 = 1in.	December. No. of wet days.	January. No. of points. 100 = 1in.	January. No. of wet days.
South-Western—*continued.*				
Kalbyamba ...	45	4	3	1
Canning W't'r'w'ks	34	4	8	1
Perth Gardens ...	55	5	15	3
Perth Observatory	63	7	11	3
Subiaco	58	6	10	2
Fremantle ...	25	5	15	2
Rottnest	16	4	2	2
Armadale ...	...	...	17	2
Rockingham ...	131	6	15	2
Canning River ...	52	4	...	...
Jarrahdale ...	87	4	25	1
Mandurah ...	40	3	6	1
Pinjarra	67	5	24	2
Yarloop	64	6	30	3
Harvey	132	6	23	2
South-West, Central Part (Inland):				
Dowerin ...	...	...	Nil	...
Momberkine ...	17	2	Nil	...
Monglin ...	29	1	...	...
Newcastle ...	Nil	...	Nil	...
Eumalga ...	2	1	Nil	...
Northam ...	9	1	Nil	...
Grass Valley ...	56	1	...	...
Meckering ...	4	3	Nil	...
Cunderdin ...	3	1	Nil	...
Codg-Codgin ...	33	3	2	1
Yarragin ...	80	3	4	2
Doongin	20	1	...	...
Cuttening ...	20	3	Nil	...
Whitehaven ...	4	1	...	...
Sunset Hills ...	21	1	Nil	...
Cobham	5	2	...	...
Yenellin	...	...	Nil	...
York	6	2	1	1
Beverley ...	9	2	Nil	...
Bally Bally ...	...	...	1	1
Barrington ...	29	3	Nil	...
Stock Hill ...	88	2	Nil	...
Wandering ...	173	3	15	2
Glen Ern ...	125	6	3	1
Pingelly ...	122	3	Nil	...
Marradong ...	93	4	4	1
Bannister ...	203	6	...	...
Narrogin ...	92	7	Nil	...
Wickepin ...	52	2	...	...

Stations.	December. No. of points. 100 = 1in.	December. No. of wet days.	January. No. of points. 100 = 1in.	January. No. of wet days.
South-West—*contd.*				
Gillimaning ...	99	6	...	...
Bunking ...	261	4	...	...
Bullock Hills ...	96	3	...	...
South-West Division (Southern Part):				
Bunbury ...	129	6	33	3
Collie	74	7	24	3
Glen Mervyn ...	125	4	42	3
Dardanup ...	65	3	22	1
Donnybrook ...	58	3	38	2
Boyanup ...	110	7	18	2
Busselton ...	60	4	11	2
Quindalup ...	72	6	30	1
Cape Naturaliste	45	4	31	5
Lower Blackwood	140	5	30	1
Karridale ...	146	9	58	4
Cape Leeuwin ...	118	10	106	9
Biddellia ...	95	4	67	6
The Warren ...	116	6	86	6
Lake Muir ...	101	7	...	...
The Peninsula ...	91	5	23	4
Mordalup ...	82	6	...	...
Deeside	98	4	24	5
Riverside ...	98	3	27	4
Balbarup ...	180	3	26	2
Wilgarup ...	88	6	49	4
Mandalup ...	...	...	...	...
Bridgetown ...	57	6	33	4
Westbourne ...	96	6	9	3
Hilton	...	...	...	...
Greenbushes ...	74	4	83	2
Greenfields ...	187	5	19	2
Glenorchy ...	90	4	15	2
Williams ...	105	7	2	1
Arthur	48	5	1	1
Darkan	...	...	Nil	...
Wagin	58	3	2	1
Glencove ...	121	6	1	1
Dyliabing ...	134	6	...	...
Katanning ...	119	6	Nil	...
Kojonup ...	105	5	3	1
Broomehill ...	190	7	9	3
Sunnyside ...	...	...	...	...
Woodyarrup ...	177	3	Nil	...
Cranbrook ...	44	3	4	1
Meanelup ...	109	...	...	...
Blackwattle ...	130	4	...	...

RAINFALL—*continued.*

Stations.	December. No. of points. 100 = 1in.	December. No. of wet days.	January. No. of points. 100 = 1in.	January. No. of wet days.
South-West—*con.*				
Wongenellup	88	4	...	...
Mt. Barker	152	9	30	4
Kendenup	82	4	16	3
St. Werburgh's	143	9	...	...
Forest Hill	118	11	59	7
Denmark	125	5	99	5
Grassmere	119	10	110	6
Albany	123	9	91	5
King River	109	5	55	4
Point King	158	6	112	4
Breaksea	253	12	49	8
Wattle Hill	121	6	...	...
Cape Riche	103	6	13	2
Pallinup	111	6	...	...
Bremer Bay	135	7	6	2
Eastern Division:				
Dural	77	4	...	...
Lake Way	31	4	Nil	...
Gum Creek	27	1	...	...
Mt. Sir Samuel	90	3	Nil	...
Lawlers	99	7	9	3
Leinster G.M.	171	5	21	1
Lake Darlôt	46	3	...	...
Mt. Leonora	49	5	Nil	...
Mt. Malcolm	163	...	3	1
Mt. Morgans	28	2	Nil	...
Burtville	72	1	...	...
Laverton	27	2	15	2
Murrin Murrin	132	6	18	2
The Granites	120	5	15	2
Tampa	125	5	2	1
Kookynie	182	8	37	2
Niagara	125	5	7	2
Yerilla	237	4	13	1
Edjudina	238	6	...	...
Menzies	167	8	2	1
Mulline	150	6	6	1
Waverley	191	5	1	1
Goongarrie	238	7	4	1
Mulwarrie	112	5	...	...
Bardoc	162	4	Nil	...
Kurawa	220	6	Nil	...
Kurnalpi	162	6	Nil	...
Bulong	133	5	Nil	...
Kanowna	155	6	Nil	...
Kalgoorlie	239	5	4	1

Stations.	December. No. of points. 100 = 1in.	December. No. of wet days.	January. No. of points. 100 = 1in.	January. No. of wet days.
Eastern—*contd.*				
Coolgardie	148	4	1	1
Burbanks	191	5	14	4
Woolubar	183	7	...	...
Widgiemooltha	162	7	Nil	...
50-Mile Tank	72	4	Nil	...
Waterdale	140	6	38	2
Norseman	151	7	Nil	...
Lake View	128	7	8	1
Bulla Bulling	248	5	26	1
Woolgangie	...	...	Nil	...
Boondie	54	5	Nil	...
Boorabbin	30	3	Nil	...
Koorarawalyee	54	5	13	1
Karalee	70	4	Nil	...
Yellowdine	107	7	Nil	...
Southern Cross	60	4	14	2
Parker's Range	127	7	...	...
Parker's Road	49	2	...	...
Mt. Jackson	81	5	Nil	...
Bodallin	53	3	Nil	...
Burracoppin	34	...	...	...
Kellerberrin	21	2	Nil	...
Merredin	13	3	Nil	...
Mangowine	65	4	...	...
Eucla Division:				
Ravensthorpe	173	6	10	2
Coconarup	115	7	13	3
Hopetoun	218	10	15	4
Fanny's Cove	194	5	...	...
Park Farm	208	6	2	1
Esperance	138	7	22	5
Gibson's Soak	228	8	28	4
30-Mile Condenser	179	7	21	3
Swan Lagoon	101	7	7	2
Grass Patch	135	7	...	...
Myrup	171	6	17	4
Lynburn	141	6	...	...
Boyatup	226	5	...	...
Point Malcolm	124	9	...	...
Israelite Bay	137	7	7	4
Balbinia	135	10	...	...
Frazer Range	190	5	...	...
Balladonia	82	9	Nil	...
Southern Hills	154	3	...	...
Eyre	229	8	48	2
Eucla	132	6	3	1

The Observatory, Perth,
10th February, 1904.

W. E. COOKE,
Government Astronomer.

By Authority: Wm. Alfred Watson, Government Printer, Perth.

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Department of Agriculture

OF

WESTERN AUSTRALIA.

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NOTES.

WIRE NETTING FOR SETTLERS.—In this issue will be found a copy of the regulations governing the supplying of wire netting to settlers. The dimension and price is as follows:—Width, 42 inches; mesh, $1\frac{1}{4}$ inches; gauge, 17; price, £24 10s. per mile, plus cost of delivery to the nearest railway station or shipping port.

OUR STATE.—In the next issue of the *Journal* an effort will be made to publish a report on the experiences of Mr. Grasby, a well-known agricultural journalist of South Australia, who is now on a visit to this State. Mr. Grasby has already been through the Eastern and Great Southern districts, and also as far North as Northampton. His views on the possibilities of the State will be worth reading, and his comments should be of value to our settlers.

ONION GROWING.—Considerable controversy has been going on in the daily Press of this State during the last few weeks, and some doubt seems still to linger in the minds of some that onion cultivation cannot be carried on here successfully or profitably. During a recent visit to the Victoria Plains District the writer saw a crop of onions being harvested that would have effectually disproved any statement that this useful vegetable could not be profitably grown here.

ORCHARD INSPECTION.—The Chief Inspector, in a recent report to the Acting Director of Agriculture, states that an orchard at Gooseberry Hill which was almost white with woolly aphis, has been cleared by ladybirds released some time ago. At an orchard near Bridgetown 50 tons had been badly infested with mussel scale. This had practically been got rid of by winter spraying with lime, sulphur, and salt. Another orchard in this latter district had been freed from mussel and San José scale by a winter spraying of caustic soda. Other orchardists had been equally successful in the use of winter spraying. It was demonstrated that, as the eggs of the scale kept alive even after being fumigated, to successfully cope with these pests spraying was by far the best means available.

KEEPING QUALITIES OF POTATOES.—A correspondent writes asking for advice as to the best way of keeping potatoes from shrinking or sprouting. The matter being referred to the Horticultural and Viticultural Expert, Mr. Despeissis replied as follows:—"The composition of potatoes, which varies according to sorts, governs, to a great extent, the keeping quality. A potato rich in starch will keep longer than one poor in that constituent. These tubers contain over three-quarters of their weight of water, and unless stored in silos or in cold chambers a proportion of that water must evaporate and cause a shrinkage. Test experiments made in the United States, and notably at the Michigan and the Texas Agricultural Experimental Stations, showed, that, firstly, no entirely satisfactory method has, as yet, been found for storing large crops of potatoes for any considerable time; and secondly, that potatoes kept in storage from September 30th to May 1st shrunk to the extent of 11·5 per cent. We know that potatoes grown in sandy loam generally keep better than the same tubers grown on stiff, heavy clay. Dipping the potatoes in an eight to 10 per cent. solution of sulphuric acid for a few minutes would, I daresay, prevent them sprouting, without injuring the corky cover of the tuber either, provided the skin was not rubbed off."

ABORTION IN MARES.—A correspondent writing with reference to abortion in mares, the Chief Inspector of Stock reports as follows:—"Abortion may be due to various causes, such as accidents, condition of the pasture, atmosphere, or disease affecting the sire. In this instance the pasture appears to be at fault, but unless an investigation is made at the time when an outbreak occurs, it is impossible to state by what means it is brought about. Sometimes a rapid growth in spring produces a stimulating effect upon the system, thereby affecting the uterus to such an extent as to cause abortion. In the event of one animal aborting, the disease should always be looked upon with suspicion, as it frequently becomes infectious. The affected animal should be immediately removed to an isolated loose-box or shed, and artificially fed for at

least two weeks, when she may be turned out to pasture, but should be separated from other pregnant animals. The fœtus or premature foal should be burnt; also that part of the pasture where the birth has taken place. Disinfect the vagina of infected animals with :—

Corrosive Sublimate	1 part
Common Salt	40 parts
Clean Rainwater	4000 parts

Also irrigate all external genital organs and tail-root of animals which show symptoms of aborting. The disease is only spread by contact, and no danger need be apprehended that others at a distance will contract the infection. I recommend as a precaution against further outbreaks of this nature, that all pregnant mares be kept at slow chain work until within a few days of foaling, and given at least two feeds of easily-digestive food daily."

Agricultural Statistics.—In order to be able to afford as early as possible in each year particulars as to the amount of land under cultivation and the anticipated yield of wheat and hay in each season the following arrangements have been approved of by the Hon. the Minister for Lands :—On June 1 in each year the Statistical Department will send out cards to all farmers in the State. On one side of the cards forms will be provided, and each farmer will be asked to fill in the area of land sown or expected to be sown that season, and to return the cards within fourteen days from date of receipt. It will not be necessary to stamp these cards when returning them, but simply to post them as they are. At the end of the fourteen days the Statistical Department will make out a list of the names of those farmers who have not returned their cards, and these will be collected by the police, and should all be in hand in three weeks' time at the latest. The information could then be ready for publication by the Government statist by the middle of August at the latest. This will give accurate details regarding the new crop for the year. Just before harvest time the officers of the Lands and Agricultural Departments will be instructed to go amongst the farmers in the various districts and find out approximately what the average estimated yield will be. This information will be received not later than the middle of October, and will then be available for publication. As at best the estimated yield will only be approximate, it is thought that more reliable returns will be obtained, and more quickly, by proceeding on these lines than if forms were sent out to every farmer to fill in. Cards will be sent out later, probably in December to all farmers in the State asking them to fill in complete harvest returns, and return as soon as possible. When these have all come to hand, which should be by the middle or end of January, they will be collated by the Statistical Department, and complete harvest returns will then be ready some time early in February.

Experimental Wheat Growing.—Mr. Norman Fry, manager of Kockatea Station, Mullewa, reports as follows:—"I have the honour to hereby give you the result of my experiments with the samples of wheat supplied to me last March by your Department. The two samples were sown side by side on some red loam (rather light) on 17th June, 1903. The ground had been cropped the previous year for the first time, and on this occasion it was ploughed to a depth of seven inches. No manure of any kind was used, and the land was ploughed the day that the seed was sown. After sowing, it was harrowed once lengthwise and once crosswise, and after the crop was eight inches high it was rolled. The rainfall was good during the period of its growth, being as follows, viz.: 17th to 30th June, 1·35 points; July, 3·15 points; August, 3·46 points; September, 3·12 points; October, 1·08 points; or a total of 12·16 points between the time the seed was put in the ground until it was reaped, being rather more than it really required. The first plot was 'Steinlee' wheat, of which I put $1\frac{1}{2}$lbs. on 132 square yards of ground. It made rapid growth, and attained a height of 5ft. 10in. This I reaped with a reaping hook, and left it lying loosely in bundles for four hot days; then I weighed the lot carefully, when it drew down at 269lbs. This was threshed out with a stick, and produced 70lbs. of grain (a sample of which I am forwarding under separate cover). The 'Allora Spring' wheat received exactly the same treatment as the 'Steinlee,' with these exceptions, $1\frac{1}{2}$lbs. of grain was sown on 174 square yards of land. It grew at about the same pace as the 'Steinlee,' and reached a height of 5ft. 6in. After being reaped and left lying loosely for four days, the lot weighed 277lbs. When threshed out it produced 70lbs. grain (sample sent). The 'Allora Spring' produced a finer straw than the 'Steinlee,' but from the results detailed above, you will see that both kinds are eminently suited for this district."

EXPERIMENTAL WHEAT-GROWING.

By Percy G. Wicken.

In his report to the Director of Agriculture on the results of experimental wheat growing, Mr. Wicken states:—"I have received the weights of the measured area of land from each of the experimental plots sown this season and have tabulated them in order to arrive at some conclusions from the results.

"The experiments were carried out on land lent for the purpose by Mr. R. G. Burges, M.L.A., Tipperary, York, Mr. R. French, Irishtown, Northam, and at the Narrogin Experimental Farm; the work of preparing the land at each place being done by the owners, the Department sending a man to sow the seed and manure and also to cut and weigh a measured plot to obtain comparative results. Plots were also sown at the estate of Mr. V. Hamersley at Cullan, near Newcastle, but the ground was so overrun with wild oats that the sown crops were almost choked out and the results not worth recording.

"The results, as given in the attached list, are the number of pounds weight of hay obtained from a measured area of 100 square yards, and are the same in each instance, the difference in the average weights being accounted for by the average crops in the different districts being good, for instance, at York, and poorer at Narrogin, owing to the wet season.

"The variety of wheat sown in each instance was the same as the settler was sowing in his own paddocks, being Lott's wheat at York, Purple straw at Northam, and Barootá Wonder at Narrogin.

"Taken all through, superphosphate gives the most even results, and almost the heaviest yield in each instance. Lime proved of benefit at Narrogin and York, but not at Northam, and the same may be said of Thomas's phospate. Bonedust gave good, even, and payable results.

"Guano proved of benefit at York and Northam, but gave less than the "no manure" at Narrogin. Potash did not prove of as much benefit as was to be expected. The soil at York seems to have responded well to the nitrogenous manure. Of the mixed manures, the results obtained from the complete manures are disappointing, and not borne out by results obtained elsewhere. The combination of superphosphate with nitrogen in the form of sulphate of ammonia appears to have given good results in each instance, while at York the combination of sulphate of potash and sulphate of ammonia has given almost top results, but this is not borne out by the action of these manures on the other plots at the same place.

"The manure for test purposes was all applied at an equal money value of 10s. per acre, and, with the exception of the lime, was mixed together and sent to the different plots ready for sowing.

"It is also interesting to note the great increase due to this 10s. worth of manure from the plot containing no manure and the best of those manured, the increase being three, and in some instances fourfold, and meaning a difference of between 1 ton and 25cwt. per acre of hay as the result due to the application of 10s. worth of manure. If these plots do nothing else they should serve as an example of the benefits to be derived from the application of manures, especially superphosphate, although how long these results will continue with superphosphate only is another question.

Manure.	Narrogin.	York.	Northam.
	lbs.	lbs.	lbs.
No Manure	56	60	50
Guano	45	177	125
Lime	95	200	50
Thomas's Phosphate	109	196	69
Superphosphate	103	228	127
Bonedust	98	174	124
Sulphate of Ammonia	80	206	125
Nitrate of Soda	107	126	126
Sulphate of Potash	65	170	109
Superphosphate and Sulphate of Ammonia ...	104	188	113
Superphosphate and Sulphate of Potash ...	86	152	156
Sulphate of Potash and Sulphate of Ammonia	97	224	103
Superphosphate, Sulphate of Potash Sulphate of Ammonia and Lime } Complete Manure	99	163	125

"Of the varieties of wheat sown at each place some proved more suitable than others. At Northam the varieties which did best and proved to mature early were Steinlee, Australian Crossbred 67, Federation, and Rerraf in the wheats, and also the American early ripe oats, all of which are worth a further trial.

"At York the varieties which did best were Australian Crossbred 67, Rerraf, and Federation wheats, and the American early ripe oats; the Garton's D special oats not proving suitable in any instance, being too coarse in the straw and too late in maturing.

"At Narrogin farm wheat known as Jade, Australian Crossbred No. 67, and Federation have done best. The American early ripe oats also did very well, and I hope to have a larger area sown next season. A variety of wheat obtained from South Australia, and known as Barootа Wonder, gave very good results at Narrogin, and matured very early.

"A few varieties of grasses were planted at the Northam plots, but were sown too late in the season to give any good results. Grass seeds, to give successful results, require to be sown immediately after the first rains in well-prepared ground, and these plots could not be sown until June. The grasses which showed most promise were prairie, Italian rye, perennial rye, and cocksfoot, and of a few fodder plants sown the crimson clover and Sheep's Burnett looked best."

LAND SETTLEMENT.

THE GOOMALLING AREA.

Interesting Reports.

The Hon. the Minister has forwarded the reports of Messrs. Terry and Lewis, surveyors to the Lands Department, in regard to the Goomalling area:—"The reports," said Mr. Hopkins, "bear ample testimony to the value of the Goomalling area as a field for settlement and development. In order that intending selectors should have every facility to inspect this valuable tract of country, Mr. Fox is being placed in charge of a survey party for the purpose of opening up a series of roads, all of which will, with the aid of a body of axemen, be cleared for a reasonable width as the survey proceeds. Mr. Fox will also supervise the sinking of a few wells, in order that ample water supplies will be at the disposal of the settler.

"Judging by the excellent reports of results achieved by those settlers who have already farmed the lands of Goomalling, the Department feels assured that big development will follow in the wake of this expenditure."

The reports in question are as follow:—

Mr. Lewis's report on country within a 20-mile radius of Goomalling:—"Sir,—In accordance with the instructions contained in your letter of the 31st July last, I commenced the examination of the country between the circles of 18 and 30 miles radius from the Goomalling Railway station, on receipt of lithos. and tracings, on the 16th August, but, as stated in my letter to you of the 25th October, other urgent surveys necessitated my leaving the classification on three occasions. The season, all through, has been a very dry one, and the greater part of the work has been done from Uberin Well as a centre, by carting water.

"On November 24, having reached the limit beyond which I could not cart from Uberin, I shifted part of my camp to Nenin Well, on the Goldfields' road, having heard a little before that a fair supply of water still existed there, in which case I should have been able to continue the work from that point. I found, however, that this well was almost dry, and on the 29th had again to shift camp to Dowerin Tank, and abandon the classification for the present, there being no water at Namalcatching or Benjaberring, on the Goldfields' road, nor, so far as I could hear, in the area to be classified southward.

"Some water which had been found in Dempster's Tanks, at Nalcain, on the east of Lake Cowcowing, by Mr. Forward and myself, on our trip to that place in August, had completely dried up before I could avail myself of it, thus rendering the examination of the country referred to in your letter impossible till the rains come again. As stated in my letter of the 25th October, I saw

sufficient, whilst on the trip referred to in the preceding paragraph, to satisfy me that a large area of good salmon gum, gimlet wood, and morrel country is to be found east of Lake Cowcowing. I rode through about 16 miles of almost continuous forest country, containing a large proportion of good red soil, from a point about five miles south of Nalcain north-eastward along or near to the Lake, and Mr. Forward assured me that this belt of country is several miles in width.

"In connection with this Cowcowing country, I may mention that I have heard from a South Australian farmer settled in the Goomalling district that several other South Australians are only waiting for a favourable report to come over and select, and inquiries have also been made of me respecting it. An examination of it would probably, therefore, be justified by definite results in the near future. The accompanying tracing shows the country examined up to the present time, being a total of 340,000 acres, besides 20,000 acres cursorily examined. I made an examination of portion of the country previously classified by the late Mr. Leeming, but found no extent of good land, suitable for selection, which had not been shown on his plan. Owing, therefore, to the scarcity of water and the necessity for pushing on with the examination of the country beyond the 18-mile circle, I discontinued the examination of this country altogether.

"The country between the Goldfields' road, Koombekine, and Ejanding has not been as thoroughly examined as it should have been, owing to the water failing, and the delineation of the forests, etc., is in places only approximate. The good forest country, with a little of the best of the mallee, has been classified as first-class, but a considerable area of mallee and thicket is to be found, which, though not good enough for selection by itself, will probably be taken up in connection with the forest as first-class land. The actual acreage of the former between the specified circles is about 26,000 acres, the greater portion of which lies to the north-east, east, and south-east of Koombekine. The area of the latter between the same circles is about eighteen thousand acres. Had water and time allowed, I would have followed up the forest country extending north-eastward from Ejanding through pastoral lease 228-97 to ascertain whether any considerable extent of forest country exists in that direction, and I think, if it be deemed advisable to continue the classification next season, that this should be done.

"The area of second-class land between the 18 and 30 mile limits, within the portion examined by me, is about six or seven thousand acres, consisting principally of scattered patches of rocky jam and York-gum country. The remaining portion is open sand plain, scrubby, gravelly plain, and low mallee and thickets, with here and there a little white gum. Of the lands comprised within the limits given in your letter of instructions, there remain unclassified—(*a*) To the south-west of Kalguddering about one hundred and fifty-five thousand acres (this country lies on the west of the country examined by me). (*b*) Near the Goldfields' road,

about one hundred and forty thousand acres. (*c*) The whole of the country between the 18 and 30 mile circles, but this country is within a reasonable distance of the Yilgarn Railway, and you verbally informed me that on this account you did not consider it necessary to examine it. (*d*) The country east of Lake Cowcowing, referred to in your letter, which probably would involve the examination of from one to two hundred thousand acres.

"The total classification necessary, therefore, to complete the instructions, as I understand you wished them to be carried out, would cover from four to five hundred thousand acres; and, if this is to be done, it should be commenced as soon as sufficient rain has fallen to enable work to be carried on. As directed in your letter, I have endeavoured to find sites for the conservation of water, where there is a probability of there being required, and beg to point out one lake at Ejanding, which is well suited for the purpose of tankmaking. Mr. Forward told me that when passing through this forest many years ago he saw a cane-grass swamp somewhere to the northward of Ejanding Soak, but he was unable to locate it when with me. He is, however, satisfied that it is there, though I failed to find it. This, if found, might prove to be a more suitable source of supply than the lake, and in any future examination or survey it should be borne in mind.

"There should be no difficulty in finding sites for tanks in the forest country around Benjaberring, as low-lying country, with a clay soil, is to be found in many places, but it will be necessary to make a careful examination before selecting sites.

"To summarise the results of my examination:—(*a*) In the first place the work is quite incomplete, owing to failure of water; (*b*) country examined to date, 340,000 acres, of which 26,000 acres are good forest or mallee, 18,000 acres mallee or thicket, which will probably be selected with the forest country, and six to seven thousand acres second-class (that is good grazing, but rocky); (*c*) a flying trip to Cowcowing, in which such an extent of good forest country was seen as to warrant a careful examination; (*d*) remaining to be examined within the prescribed limits of 18 and 30 miles from Goomalling railway station (omitting that portion referred to, consisting of about 300,000 acres)."

Mr. Terry's report of country 10 to 15 miles beyond the area reported on by Mr. Lewis:—

"In accordance with your instructions, dated August 25, I proceeded to Cowcowing Lake, reaching there on September 4. My work was to make a surround traverse of Cowcowing Lake, and to classify within certain boundaries, being generally from 10 to 15 miles beyond the 30-mile radius from Goomalling.

"Area.—The total area dealt with, including lakes, was 350,000 acres, the area occupied by lakes being 40,000 acres. The respective areas are:—First-class, 89,000 acres; second-class, 23,000 acres; third-class, 116,000 acres; fourth-class, 54,000 acres; the balance is lake country. The country is undulating, attaining a

fair eminence at Dandarragan, around the top of which a site for a reserve for triangulation has been marked off.

"*Timber.*—The timber is mostly salmon gum, gimlet wood, morrel, and mallee; with jams, York gum, and manna gum at the soaks and feeding patches. Of the smaller kinds are sandalwood, quondongs, clay, and other prickly bushes. The thickets are mostly a kind of ti-tree and oak, which grow very high and dense.

"*Water.*—On the west and north-west of the lake there is a plentiful supply of small lakes, owing to the prevalence of granite, but, with the exception of Booralming, Doodaring, and Dandarragin, they are not of a sufficiently permanent nature to warrant reservation. Booralming has already had a reserve allotted for it, viz., 536 acres. This I have increased to a square mile in area, because, should ever a railway traverse this country this is where it would probably pass, and the position is eminently suited for a townsite.

"Doodaring is another very good soak, and, with settlement taking place, would be in the line of future cart traffic. This has a proposed reserve around it. Dandarragin, though also a good soak, is isolated, and surrounded with very little country of good quality. I have, therefore, not suggested a reserve.

"To the north-east of Booralming is a fresh-water lake, which, if scooped out, would make a fine tank, and should be reserved. On the east of the lake granite is very scarce, and, consequently, there are very few soaks; these, being too insignificant for a water supply, are not worth reserving. Areas have been marked off where water could be caught in tanks.

"The first-class land is almost entirely forest country, consisting of gimlet wood, salmon gum, morrel, with mallee; the exceptions being to the north of Lake Wallambin, consisting of thicket and some mallee, and the feeding places around the soaks, where, as mentioned previously, the timber is jam, York, and manna gums.

"The bulk of the good land lies to the east of Lake Cowcowing, and although I was under the impression that my eastern boundary had practically cut out all the good land on that side, I have since been informed by an old sandalwood getter that the forest country forms again, and runs along the north side of Lake Wallambin for about six miles, with an average width of three miles. Immediately to the west of the lake there is a considerable area of good country of an irregular and broken shape, which again forms about the lake country to the north, running towards Bagerin, and I am informed by the same authority that it extends with a varying width of three to six miles for 30 miles, and probably further, 30 miles being the furthest my informant had been. The further you leave the lakes, the more scattered the good country becomes. The second-class land consists mostly of mallee, or forests of salmon gum only. The third-class is sand plain, with

mallee and tamma thickets. The fourth-class is gravel plains, with low scrub, mallee, and tamma thickets, and covered with rock poison.

"*Rainfall.*—I am informed that the rainfall is fairly regular, ending generally about the end of March, but, since wherever you go you hear that the seasons are quite different to what they used to be, it is doubtful whether my information is reliable. It is, however, worthy of notice that during my stay here, while the South-Western division was experiencing an abnormal rainfall, we received hardly any rain of any consequence, there being one good downpour only. This, as you know, has been an exceptional season, and, consequently, I had the opportunity at Dowerin and Koombekine of seeing what country of this description could do in growing wheat under the best conditions, and can safely say that nowhere in my travels have I ever seen a crop to equal that at Koombekine. This was being cut at the end of October. The lakes generally are filled up and covered with samphire, there being basins mostly around the margin. These hold a few inches of water, which, when the latter dries up, hold a deposit of salt. Although too soft to ride or drive over, the surface of the lakes will anywhere bear a man's weight. Around the margin of the lake is flat, lakey country, defined on the plans by broken green band. Within this is some very fine land, and I see no objection to selection going to the lake. It has to be borne in mind, however, that owing to the number of small salt lakes a considerable area would be lost to the selector. Although being generally flat and showing good pasture, the question arises whether deep-rooting things, such as fruit trees, would thrive, as I am of opinion that salt is near the surface.

"*Improvements.*—At Nalkain Mr. Dempster has two tanks, valued at £150; and about two miles further to the North in the lake he has another, valued at £50. I have enclosed these in a reserve. At Cowcowing Mr. Buckley, the lessee, has a well worth £10. A large reserve has been placed around Cowcowing, as in this area there is a number of clay pans where water could be conserved. At the North-East corner a large reserve has been marked off. This country looks auriferous, and I believe specimens have been picked up.

"Taking the area as a whole, I was very pleased with the country, and have no doubt that, with a railway, or with the promise of one, the whole of this good country would be snapped up; and, as the good land extends northerly, I would advocate the taking of the line along the west side of the lake, passing through Ejanding and Booralming. As a matter of fact, I have been told that several South Australian farmers have expressed their wish to come out on to this area, and that they had friends who would take the lot, the fact of there being a sufficiency of ground to carry a considerable number being one of the attractions. The theodolite survey of the lake surround amounts to almost 70 miles, and, in doing this work, I had to cart water only twice. The survey came in very useful as a datum for the compass classification lines.

Owing to the number and density of the thickets I was unable to do much horseback traversing, it being impossible to keep anything like a course. In consequence, most of the work was done on foot, with the result that it is fairly approximate, and further, the daily record was equal to, if not greater, than would have been the case had a horse been used."

THE GREAT SOUTHERN DISTRICT.

Report from Katanning.

Mr. H. J. Starr, the Government land agent at Katanning, in his report for January, has a glowing tale to tell of the business transacted in his office during that month. He gives the following particulars:—

The complete details hereunder show a satisfactory continuation of the settlement, which is going on at a very rapid rate on the Great Southern railway. It is gratifying to note the steady influx of selectors from our sister States, who are desirous of settling on our lands. These men seem to be of the right kind, very up-to-date in their ideas, and, no doubt, practical farmers, who will be great acquisitions to the State. Another matter for congratulation is the quantity of improvements these selectors are doing, being far in excess of that required by the Act.

Large areas of land are still open for selection in this district, more especially south of Katanning, and, judging by the number of letters received and inquiries made, I anticipate a large number of selectors from the Eastern States during the next two months.

During the month business has been fairly brisk, and, although short-handed, the officers have worked very hard to keep up with the ever-increasing business transacted at this office. More assistance is urgently required.

The applications taken at this office for the month were:—

Under section 55 (residence), 99 applications for 19,528 acres.

Under section 56 (non-residence), 25 applications for 4,099 acres.

Under section 61, one application for 700 acres.

Under section 74 (homestead farms), 72 applications for 11,520 acres.

Under section 68 (grazing lease), one application for 400 acres. One town lot.

This makes a total of 199 applications for 36,247 acres, subject to compulsory conditions of improvement. These applications were made by 116 different people, 72 of whom were new selectors from the goldfields and Eastern States.

Only one application for a town lot was received during the month, but 94 instalments of town lots, 11 instalments of ordinary suburban lots, and nine instalments of suburban lots for cultivation were received. Nineteen Crown grants were dealt with, including 15 for town lots and four for suburban lots, together with two duplicate leases, one duplicate occupation certificate, and one change of clause. Thirty-four transfers were dealt with.

Notwithstanding that January has always been a fairly quiet month, the total receipts from all sources totalled the large sum of £1,337 6s. 10d.

Great activity is apparent among selectors desiring to avail themselves of the more liberal provisions of the Agricultural Bank. Twenty-two applications, for loans to the amount of £2,900, were received, and the fees and interest received on behalf of the bank totalled £221 17s. 6d.

DISTRIBUTION OF PARASITES.

By E. H. Bailey.

I beg to further report having collected and sent away to various applicants the following colonies of beneficial insects:—

L. Hesperidum.—Five colonies of scale containing parasites.

L. Oleæ.—Thirty colonies. In only a few instances imago parasites sent or personally delivered.

Rhizobius Ventralis.—Five colonies, mostly larvæ and pupæ, and a few beetles.

Cryptolæmus Montrouzierii.—Six colonies of this useful beetle for *Dactylopius*, mostly larvæ and pupæ.

Leis Conformis.—Twelve colonies sent to those troubled with woolly aphis.

All the foregoing beneficial insects are the result of those sent to us in 1902 and last year, and it will be seen from the above list how they are multiplying.

Besides the above, colonies of parasitised cabbage moth, cabbage aphis, also the yellow-banded syrphus fly, and some beetles (*Chilomenes Quad.* and *Coccinella Repanda*) have been collected and sent away.

ORCHARD INSPECTION IN THE ALBANY DISTRICT.

By T. Hooper, C.I.

Mr. T. Hooper, the Chief Inspector under the Insect Pests Act, has just returned from a tour of inspection through the Albany District, and reports as follows:—

"I beg to report on my visit to Albany *re* the spread of codlin moth in that district. Last year Inspector Vaughan made an inspection late in the season, when much of the fruit had been picked. He found four orchards infested with the codlin moth. This year Inspector Breen started the inspection much earlier, and up to the present has found five more orchards infested. The finding of these five fresh orchards has given rise to a feeling of alarm amongst the growers, as they think the pest is spreading fast. As last year's inspection was late, we have no reliable data to go on, but I am of opinion that some, if not all, of those gardens may have been infested last year, as the five fresh cases are within the area bounded by the four previously found.

"Accompanied by Inspector Breen I visited the infested orchards, and found most of the fruit stripped. I consider good work has been done, and Inspectors Breen and Lankester are now completing the cleaning of these orchards. All the fruit has been destroyed with the exception of Mr. J. F. T. Hassell's orchard, where there are 20 trees; here the fruit was all picked and examined by Inspector Breen, the diseased fruit destroyed, and the remainder passed to a Chinaman in charge, who, I believe, is feeding the fruit to pigs. There are other gardens within the infested area which have been inspected, and will continue to be so; up to the present they appear clean, but any day may reveal the presence of the moth. Some of the infested trees are very big, and it is impossible to find all the fruit right off, every day will show up an odd fruit.

"I consider the moth has got a hold, and I have very little hopes of ever stamping it out, but will do what I can to either stamp it out or check it.

"I made a visit of all gardens and orchards outside Albany on the King River road, going out about seven miles from Albany and inspecting 10 places. I went carefully to nearly every tree, but the fruit appeared quite clean in all instances.

"I visited an orchard called Candyup, nine miles from Albany, on Calgan River; there were about four acres, mostly big old pear trees; could see no signs of moth. I inspected four gardens on the

Middleton Road, about two and a-half miles from infested area; could see no traces of moth. Monday afternoon I helped Inspector Breen to complete the stripping of a very large pear tree at Mr. Williams's. We got about 20 pears; a few had young grubs in them. The tree is about 30 feet high, and it is impossible to examine every fruit. I then, with Inspector Breen, visited two or three of those orchards that he and Inspector Lankester had completed, and found them well cleaned up."

ABORTION OF MARES.

By R. E. Weir, V.S., C.I.S.

An outbreak of abortion or premature birth amongst mares in the Greenough district was recently reported to this department, and as the malady is of frequent occurrence amongst dairy cows and stud ewes, a *résumé* of the causes which bring about this trouble, together with treatment in cases of outbreaks, may be of advantage to many stockowners.

Causes.

The causes of abortion are many, for instance, accidents, rough handling, acute indigestion, and ergotized food are chiefly to blame for many premature births. In instances where a number of animals become affected at once and without any apparent reason, the cause then is the result of a microbe which is found present in the fluid discharge which is expelled with the fœtus. In this instance the disease is infectious, spreading rapidly from one pregnant animal to another, until nearly all in the herd fall victims to the disease.

Treatment.

Immediately an animal aborts she should be separated from the others, and the fœtus, together with the membranes, burnt. The womb of affected animals should be cleansed by means of syringing with the following solution:—

Corrosive Sublimate	1 part.
Common Salt	40 parts.
Clean Rainwater	1000 parts.

A careful inspection should be made of all other pregnant animals, and should any show signs of aborting the external organs of these should be washed daily with a supply of the same solution. In the event of a cow or mare aborting they should be stall fed until complete recovery takes place, for should they be allowed to graze about they are liable to infect the pasture. Care should also be exercised in the case of sires, as when they are diseased infection mav be brought to the female.

OUR ILLUSTRATIONS.

Peach Trees covered with Hessian.

Two orchard pests, hard to get at, are at times very troublesome. For several years past the more destructive of the two, viz., the maggots of the Fruit Fly (*Ceratitis capitata*), have been successfully checked by wrapping the trees up in light hessian, or in cheese-cloth material (*see* Fig. I.). This season the Fruit Fly has hardly been noticed at all; but quite as destructive a pest, the "Silver Eye," a sort of tomtit, has proved particularly troublesome; and the covers provided against an attack of the Fruit Fly have proved efficacious in saving the peach crop from the indiscriminate peck of the "Silver Eye."

The fruit protected under cover will ripen with as much ease as uncovered fruit, but will fail to "colour" properly; and it is advisable to expose it to the direct rays of the sun four or five days before picking for packing. The photograph was taken at the Woodbridge orchard.

A Convenient Orchard Cart.

The illustration (Fig. II.) shows a cart well adapted for orchard work. The axle, which has an elbow, permits the lowering of the floor of the cart and its easy loading, whilst jolting is also reduced. The wheels have also wider tyres than an ordinary spring cart, and are, for that reason, better suited for work on land kept highly cultivated.

Peach Tray.

Of all fruits, figs and peaches are the hardest to pack; and it is so easy to bruise them, that first-class fruit when leaving the orchard often looks like unsightly pulp on opening for sale.

The ordinary bushel fruit case, although very suitable for packing the tougher fruit, such as apples and oranges, is unsuited for packing peaches and the more tender fruit.

The illustration (Fig. III.) shows a peach tray, cut and made at the Woodbridge orchard. It consists of a shallow tray lined with white paper, in which the peaches are arranged in rows, one layer deep. The most convenient size is a tray measuring 23in. x 16in. and 2in. to $2\frac{3}{4}$in. deep. The greater depth is obtained at will by nailing light battens $\frac{1}{4}$in. deep at each end until the cover can be fastened without bruising the fruit.

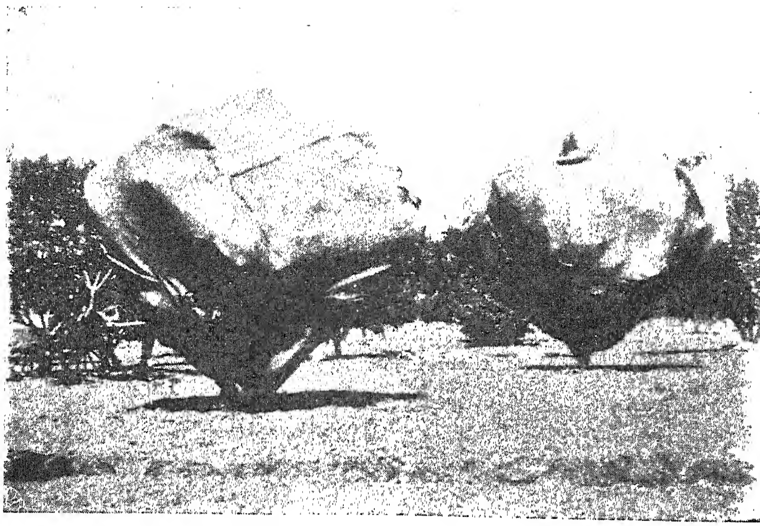


FIG. I.—Peach trees covered with hessian.

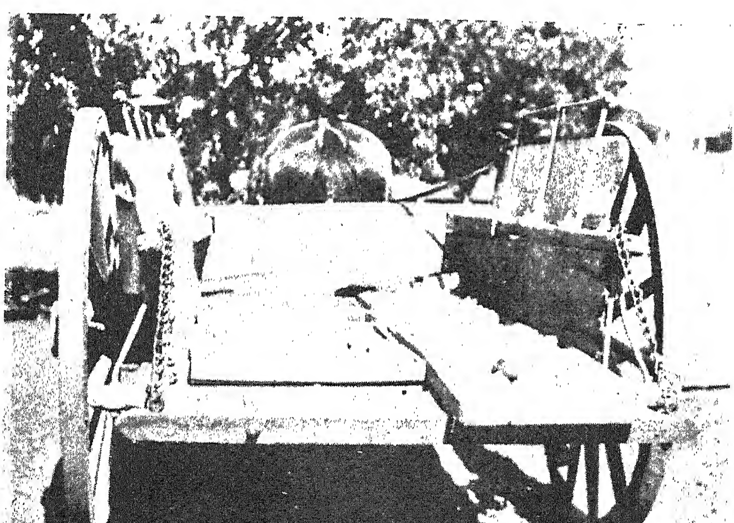


FIG. II.—Orchard cart conveying trays of fruit to packing shed.

Artesian Bore, Woodbridge.

Some eight years ago, Mr. C. Harper put down at Woodbridge one of the first artesian bores in Western Australia. A good supply rose to some feet above the surface from a depth of 236 feet. As more land was brought under irrigation, another bore (*see* Fig. IV.) was put down last year, a quarter of a mile from the first one, and proved quite as satisfactory. Water was reached at a depth of 220 feet. The bore continued to the depth of 240 feet. The daily supply amounts to 200,000 gallons.

BEE NOTES.

By J. Sutton.

Bee-keepers, like other people, have their troubles, discouragements, and many set-backs, but the present season gives many quite a new experience; it is one which will not be forgotten for some time, seeing that little or no honey has been produced in any part of the State, and the present prospect is far from being encouraging. Indeed, those who have a few hives should be very careful, even if a little is being gathered, not to kill the goose, etc.; that is to say, they should be careful in taking the little there is, lest the bees should not be able to gather sufficient to carry them through the winter season, and furthermore, should see that any weak colony or colonies are doubled up and made strong before the end of the season. Strong colonies may carry on and winter safely, but weak ones will stand a very poor chance, unless the coming winter is very mild and favourable.

To one interested in bees it is an interesting sight to go into any apiary and find the bees flying and bringing in nectar; this is certainly the exception this season instead of being the rule.

Travelling from Perth to Bridgetown, not a single tree and only very little shrub is in bloom, and what there is contains very little nectar, hence bees cannot obtain much anywhere. The same may be said respecting the Eastern districts. Travelling from Perth to Albany, right through from Wagin onward, the same tale is told; bees are doing nothing. At Katanning it is a little better, and nearer the south coast we find an improvement; at Mt. Barker bees are doing well; on towards Bridgetown prospects are good; at Forest Hill red gum and the yate are blooming freely; from Hay River to Torbay Junction trees and shrubs are very nice to look at from the bee-keeper's point of view, and, where attention is given, the bees are not doing so badly.

Albany, for its size, has a large number of bee-keepers, but only very few of them make any effort to market their honey, hence some old hives are only looked at now and again when a little honey is wanted.

Several cases of chill brood and one or two of foul brood came under my notice, both resulting from inattention by the owners.

Attention and care where stocks are weak may help in averting trouble, but if not given, trouble will result that may affect not only the owners but also others who give every attention, because once disease gets a hold, the colony soon begins to dwindle and get weaker, when a strong colony takes advantage and robs the weak one, carrying disease and death to their home.

I feel like repeating my advice to all and sundry respecting keeping strong colonies, but where this may not be practicable, see that weak stocks have only as many combs as there are bees to cover, giving a single comb as it may be required. Bees will do better and build up faster with this method. There is no doubt it would be less bother to fill the box with frames and let them rip, but in most cases it means loss and trouble.

It is sometimes most amusing to see how some people catch on to the proper methods of working bees to advantage while others cannot do it anyhow. One case in point came under my observation a few days ago. I had previously visited a certain apiary, bees would not go up into the sections, and to gain his point this apiarist had placed the section box, without starters, under the brood nest. I need not say with what result. However, I put things into shape as best I could, pointing out that he need not expect sections to be filled so long as the brood nest was almost empty.

Let me counsel those who have little available honey to assist by giving a little feed to any stocks that are weak. Better to do this than to lose the lot, and be sure that sufficient honey is left for the bees to carry through the coming winter season, which it is to be hoped will not be so long or so severe as the last was.

Don't despair; this is the first bad season in Western Australia for ten years. Certainly to a new beginner it may be discouraging; but look ahead and never say die, and your efforts will bring satisfactory results.

The Ant Trouble in Apiaries.

Several have asked, and others have written to inquire, what is best to keep ants under control. As I have not had any serious trouble myself, I have had to experiment a little in this direction, and find that, with a little attention, they can soon be brought under control or cleared out of the apiary. In one case where they were exceedingly strong and troublesome the nest was found and the ants roused up, then they were sprinkled with a little Paris green

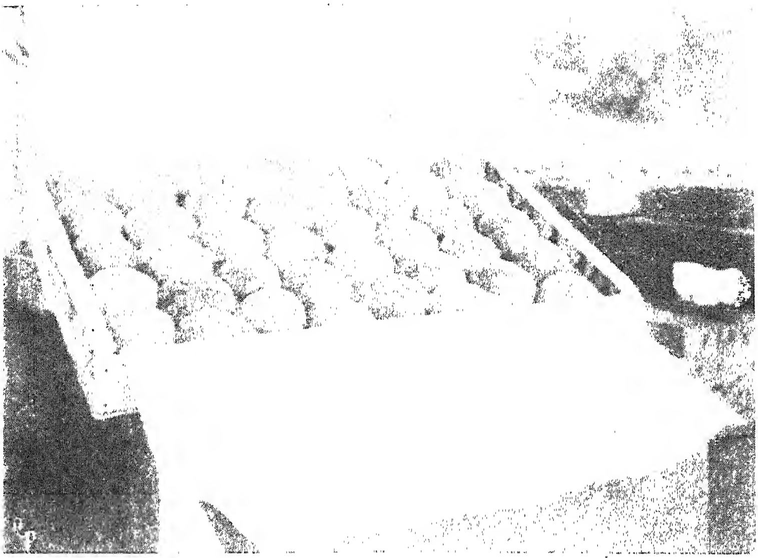


Fig. III.—A new fruit tray for sending fruit to market.

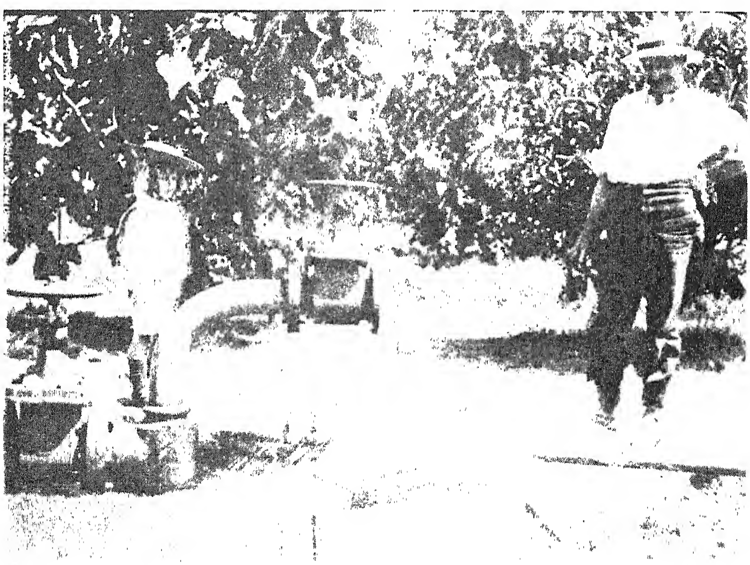


Fig. IV.—Artesian bore at Woodbridge Nursery.

powder at sundown. This completely killed or drove them away. At my own apiary I have tried Insecticide with complete success.

Strong colonies can generally hold their own against this pest, but even then it would be better to destroy the ants where possible. Weak colonies are at the mercy of the larger ants, and should have the attention and assistance of the bee-keeper until they are stronger. I think it would be doing a great service to the industry if those who are troubled with this pest would try one of the above means to eradicate the pest and then send in their experience to the *Journal*.

[In a recent issue of *Gleanings*, an American bee paper, the sprinkling of air-slacked lime on the ground and under the hive has proved very efficacious in keeping ants away from the hives. —Ed. *Journal*.]

COLONIAL VINTAGES.

The wines produced in our colonies, which are invariably richer and stronger than those produced in France or Germany, would lose much of the crude qualities which are characteristic of them were they left to mature. While these wines, be it said, have many excellent points, they cannot at present compete as regards delicacy or *finesse* with the more classic wines of French growth; but the vintages of our colonies, owing to the steadier condition of climate and to an abundance of sun, are, as a rule, more certain and more regular than the French or German vintages, and thus the wines of Australia are constant in character, always full and always generous. Of a similar character are the wines of California, Spain, Algiers, Greece, Turkey, and Persia. There is an undoubted future for our colonial wines, and some day not far distant it is to be hoped that they may appeal to the connoisseur's taste more than they do now and be of a more refined character. Colonial wines at the present time are very popular, partly because they are cheap and partly because of their "vigorous" character. It has been said that the day of glorious vintages in regard to French wines has passed, and that never again shall we see such exquisite wines as were produced in the Medoc, for example, in 1864, 1865, 1874, 1875, or even 1888 or 1889. We do not believe it. . . . . In spite of indifferent seasons, ordinary table claret, when procured through respectable channels, has never been so good, so plentiful, and so cheap.—*The Lancet*.

POULTRY NOTES.

By Frank H. Robertson.

Now that the prices of staple products such as wheat and chaff have greatly fallen from that of the past few years, it is likely that many farmers will pay greater attention to the production of poultry and eggs for the Perth and goldfields markets. The number of farmers who regularly forward fowls and eggs to these markets is a very small proportion of the total. There are certainly some poultry on every farm, but in most cases the eggs produced are only for home use; occasionally one drops across a farmer who takes a live interest in his feathered stock, keeps the right kinds, looks after them properly, and makes them pay handsomely. I can call to mind one farmer near Geraldton who has some four or five hundred hens chiefly Leghorns, with Andalusian and Minorca crosses. He keeps them in flocks of about 100 each, about a quarter mile apart. No houses or enclosed runs are used; the roosting accommodation is all obtained in the low growing scrubby timber with which this district abounds. Wheat is the staple food used, and this farmer is so well satisfied that he considers it pays far better to feed his wheat to fowls than to sell it.

Another farmer in the Eastern District runs a similar number also in separate flocks, but not having such thick timber partly relys on house shelter. The small boys of the family look after the fowls, which are chiefly Minorca and Leghorn, but few runs or enclosures are used. The various flocks are well apart and do not mix to any extent. Wheat is the chief food; variety is of course obtained on the free range.

In the South-Eastern District a farmer there hardly ever feeds his fowls, as they pick up their own living nearly all the year round, and keeps good laying sorts. The colony system is successfully adopted, and is one which could well be copied by almost every wheat grower, viz., by having a few movable houses which are taken to different parts of the paddocks after the crops have been taken off; the fowls are removed to these temporary abodes at night time, and there they remain until ready for the market, having been fattened at no expense, and the only labour being the supplying of water and the removal of the house a few yards once a week.

In the majority of farms the custom is to allow the fowls to wander all over the place, frequently no houses are used, and roosting accommodation is obtained anywhere and everywhere, and in such cases they become a nuisance, and in the daytime are a constant source of annoyance owing to their too frequent presence in the stables and the horse feed, and where there is a garden or orchard a good deal of damage is done to the ripe fruits. In all such cases it will be found much better to either keep the fowls in an enclosure

or else by the use of wire netting fence in the places to which the fowls are not wanted. In most instances the better plan will be found to enclose the fowls in a suitable locality within easy distance of the homestead; an area of say an acre or two could be devoted to this purpose, but should the land be devoid of good natural tree shelter it will be found necessary to supply it artificially, and for this purpose it will be hard to find a more suitable shrub than the castor oil tree; it grows very quickly, the foliage remains all the year round, the limbs are smooth barked and well spread out, thus affording excellent roosting accommodation. Other good trees would be tree lucerne and fig trees, and in addition the wire netting fence can be made both useful and ornamental, first as a suitable trellis for the passion vine, and at the same time acting as a breakwind for the poultry, to keep them comfortable in cold weather, for it should always be remembered that fowls running in bare exposed enclosures do not thrive well, they require any amount of shade and shelter. The number of fowls to be kept on such an enclosure would depend on the nature of the soil, and for this purpose a light sandy soil is the best, and if it is on the lee side of a slope so much the better. If the ground is of a heavy nature it will not carry so many head as the light soil. The chief point to watch is that the ground does not become foul, and in the slightest degree evil smelling, but to be on the safe side 100 head to the acre would be found sufficient for all the year round in most cases, but as the number of stock kept must necessarily vary, a good plan is to decide at the beginning of each season how many young birds are to be raised; 200 head would not be too many to rear and handle without any great worry or time and attention; thus a fair stock to keep would be say 100 laying hens, for which in the breeding season would be required from 8 to 12 cock birds; market the eggs from the 100 hens, and sell 200 head each year. Working on these numbers in an intelligent manner would result in a good addition to the farm income, for be it remembered that the prices are very good; the average price for eggs in the Perth wholesale market works our at about 1s. 10d. per dozen, ra nging from 1s. to 3s., and fowls for killing range from about 5s. to 10s. a pair, according to quality. These prices are much better than any other State in Australia, or probably in the world, except South Africa. We are now almost on a level with the rest of Australia so far as values of grain, but are a long way short of our egg demand. We have a splendid market right at our own door, and when that is filled, which will not be for many a year, we are geographically better situated than any of the other States to take advantage of the foreign markets for an export trade. At the present moment New Zealand and New South Wales are doing a big trade with South Africa, but cannot supply the demand.

Western Australia has a great advantage over the Eastern States in the matter of a market for her poultry products, from the fact that we have a large population in the mining centres, where fowls cannot be successfully raised to any great extent. The consumption of both poultry and eggs on the goldfields is very great,

and would be very much larger still if prices were lower. The demand, owing to the warmth of the climate in those localities for a light and nourishing food, such as fresh eggs and poultry, is very constant and but ill supplied. Most farmers admit that poultry production pays well, and many of them have expressed their intention of paying more attention to the matter, and for those who purpose doing so it would be wise to soon now begin to make alterations where they are required, so as to make an early start for next season, as June, July, and August are good months for chicken-hatching.

Insect Pests of Plants, and their effect on American Agriculture.

By Prof. J. M. Webster, of Illinois.

I wish to approach this subject, assigned to me by your president, by calling your attention to the fact that, without agriculture, there would be no such pests. That is to say, destructive insects were never created as such, and they become pests only when they come in contact with the ever widening and varying interests of the husbandman. A weed is but a plant out of place, and an insect may be either beneficial or innoxious to-day and a most destructive pest to-morrow, precisely as the plant upon which it feeds comes to possess a financial value. The dusky aborigine, whose cultivated fields were few and far between, had little difficulty with insect pests, and this was true in case of the white pioneer, because there was food for man and insect in plenty, and this fight for life between man and the most diminutive of the lower animals had as yet scarcely begun. The red man and the bison have succumbed to the Caucasian, and are practically exterminated, because of their inability to adapt themselves to the changed conditions prevailing through the influences of civilisation. Insects do not give way to the white man so easily; the minor here become the major, and they adapt themselves to changed conditions as to food plants, prey upon the crops of the farmer, and thereby become insect pests. Therefore, like the poor, they have been always with us, and always will be. The whole problem is summed up in the efforts of natural selection to keep pace with artificial selection.

Besides being tenacious, as I have just shown, insects differ from man and the larger animals in many other ways, and we find that what in many cases appears the weaker is by far the stronger. Man and many of the larger animals mature slowly, their progeny are few in number and produced at more or less protracted intervals. An insect born to-day may itself produce young within a week, not

singly but in myriads. It might almost be said that animals reproduce in numbers and frequency inversely to the amount of their avoirdupois, the most gigantic producing but a single young at long intervals, while the offspring of a single insect mother may number thousands, and some of them go through their entire life cycle within the space of a few days.

Again, as we sit here beside of one of the world's greatest natural wonders, with our own starry banner floating grandly in the breeze, the soldiery about it coated in blue, we look across the narrow and and restless thread of water and behold another equally proud banner, this one largely of red, embellished with the cross of St. George, and the soldier is there coated in red. We have but to cross the short steel path that spans this swift river and we are in another country, with different laws and political regulations, with different rulers. Now, if *we* cross back and forth between these we are stopped, questioned and perhaps searched by officers of either one of these nations, but the little honey bee wings her flight back and forth from the clover fields on either side of her hive, lands her cargo duty free, and all the power of King Edward and President Roosevelt combined cannot prevent her doing so. We have but to go to the banks of the Rio Grande river far to the south to witness a parallel to these same conditions. I have used the honey bee as an illustration of my point, but later on I shall show you that there are many other and destructive insects that proceed in much the same manner, bidding defiance to the laws of nations as well as of states and territories. One of the worst scourges of the cotton field made its way across the lower Rio Grande river from Mexico a few years ago, and is now spreading its blighting hordes over the cotton growing regions of the south, with a final result of we know not what to this most important industry. It is no uncommon thing for an insect, introduced into this country from abroad, to radically change its habits on becoming established among us, and thus not only survive but become decidedly destructive as well. What has come to be known as the Buffalo carpet beetle, introduced into the Atlantic states from Germany, and into California from Asia, which has created almost a panic among American housewives in the East, in California and in Europe is unknown as a household pest, living there in the blossoms of plants. Thus we find that insects are exceedingly prolific organisms, cosmopolitan, seemingly capable of adapting themselves with ease to almost any climatic changes or variations in the nature of their food supply. Their fossil remains, preserved in the rocks, teach us that while man and the larger animals come and go, they live on, we might almost suspect for ever. Let us now see what they cost the American farmer, and whether or not they are of sufficient importance for him to consider, as a factor in his business.

In the past, on every $1,000 worth of farm produce marketed by the American farmer, a tribute of over $100 or over 10 per cent. has been paid to the great army of destructive insects. In other words it costs the agriculturists of America over $300,000,000

annually to support this devastating horde of destructive insects, and the figures given are based on very conservative estimates. The last National Congress appropriated for the use of the United States army, and naval service, combined, the sum of $170,586,499·54, only a little over half the above amount, and the farmer shook his head over the magnitude of these expenditures In 1900, the latest statistics to which I have access, show that the entire expenditure for public education in the United States was $213,274,354. For the year 1900-1901 the government and municipal appropriations for universities and colleges of liberal hearts in the United States was $5,052,392, the total income of these during the same year being $22,789,054. From these figures we can see that it costs us more to keep these insects than it does to educate our children, and the loss does not fall upon the whole population but upon those whose interests are in agricultural pursuits. It is the farmer who pays this tribute of one dollar of every ten for the support of the insect enemies of his crops, yet few agricultural colleges require the study of insects at all! The loss by fire in the United States during the year 1902 was estimated at $140,000,000, the average annual loss since 1874 being $114,066,953, and again we find that the loss through insect attack is more than twice that by fire. We have fire insurance companies galore, but who ever heard of an insect insurance company? A $10,000 fire in one part of the country is heraled from one side of the continent to the other and more stir occasioned than does the attacks of the cotton boll weevil in Texas, whose ravages the present year will probably amount to upwards of $25,000,000. The chinch bug may work a $20,000,000 damage in the timothy meadows of New York or in the wheat and corn fields of the middle west, and attract less attention than a $20,000 fire in Chicago or New York City. From the best information that I am able to obtain, this chinch bug, between the years 1850 and 1898, caused a loss of $330,000,000. If fire losses were as great as losses by insects, insurance companies as at present organized would have to close up business. These are losses the magnitude of which can be approximately estimated because the effects are not as obscure as in many instances of insect attack. There are insects whose methods of attack are so obscure and covert that they are not usually discovered at all by the ordinary farmer, who simply knows at the end of the year that his crops have not done well, and the year has been an unprofitable one for him. Perhaps some of the wheat straw worms have attacked his wheat, and the result has only shown in the shriveled condition and light weight of the kernels, with no aprarent connection between the two. His corn has not grown well, the ears are short and not well filled out at the tips, precisely as if his land was lacking in fertility or a drought had prevailed, and he may lay the loss to either the weather or his land, whereas it was the corn-root worm that ruined his crop, a pest that he might easily have avoided. His timothy meadow has died out, and he does not know why it should have done so, when, had he looked carefully about the roots, he would have found the short-winged form of the ching bug present there in myriads. Such

losses as these are not considered at all, and do not enter into consideration, either by the farmer or statistician, unless they are of such magnitude as to devastate large areas of country, and the figures that I have given, though they may appear large, are more likely to be under than overdrawn. Here we have a financial loss, falling upon a single industry, nearly three times as great as that caused by fire, and to ask if such a factor should be reckoned upon and carefully considered by those engaged in that industry appears almost ridiculous, as it would seem to go without saying that such elements should not only receive most careful consideration, but every effort should be made by those engaged in that industry to familiarise themselves with the minutest details thereof in order to by every possible means protect themselves against its adverse influences. In no other business under the sun would such an important element escape most careful and thorough consideration, and every person engaged in that industry or business would be as familiar with the details thereof as possible. Judging from my own quite extensive acquaintance among the farmers of the middle west, having spent my whole life among them, and over 20 years as an entomologist, working upon the problems indicated so clearly by the title of my paper, I do not believe that more than one farmer in a thousand has any conception of the nature of the insect enemies of his crops that are permanent residents of his premises, and liable at any time to occur in sufficient abundance to cause him a greater or lesser financial loss. One of my own tenants is a good farmer, as the term is applied among farmers; I have had him with me for 18 years, but in all that time he has not learned to recognise a single insect in its different stages. He knows the cut-worm when he finds it at work in his cornfield, as also the wire-worm when observed under the same conditions, but he does not know a thing of these in their adult stage. If I talk to him about the insects of the farm, he listens respectfully for awhile, may ask a question or two, but again, more out of respect than anything else, finally steers the conversation into the cost of fattening the last carload of cattle or hogs, repairs to the barn, a new variety of oats—anything else except insects, which he cannot understand as being of any special interest to him. Now, I have got a good farmer, and I believe that his interest in applied entomology is on a par with that of most of the tillers of the soil generally over the country. From my acquaintance with them, gained by months of residence among them on their plantations, I believe the southern planter is better posted in this direction than the northern farmer. The planter is not always in so much of a perpetual hurry, has more leisure to read and think, and his neighbours of equal social standing, being more widely scattered, whon he meets them are more inclined to discuss such matters together and thus exchange opinions and experiences. In other words, he perhaps reads less, but digests better, and if he had the same grade of labour that exists in the north, so that he could get his wishes intelligently put into effect, the problem of insect control would come nearer a solution, in many cases, than is now being done on the northern farm.

Again, I do not believe that men engaged in other lines of business and also in farming, pay as much attention to the insect problem as they would do if it were another element entering into some of their other interests. I will explain my position by illustration. Some years ago, a banker called me up by telephone and asked me to meet him at his office, in order that he might consult me relative to serious trouble in his corn, of which he had about 10,000 acres growing in an adjoining county. I found him very much concerned over what appeared to him as an entirely new trouble that was likely to cost him a small fortune, his crop being damaged in some fields from 25 to 75 per cent. He was sure that it was an entirely new pest, as he had never heard or read anything of the sort. It did not take long to give me sufficient details to show conclusively that it was the corn root worm that was ravaging his fields, and, as he stated, costing him at least $10,000 per year. It was pointed out to him that the pest was not a new one, but on the contrary had been known as a serious enemy of corn for many years, and that the remedy, a rotation of crop was entirely within his ability to carry out. Besides, it was shown him that full descriptions of the insect, its method of attack and importance to the corn-grower, had all been published over and over again. Surely, if his receiving teller at the bank had accepted a very limited number of counterfeit fifty-dollar bills, the matter would have received prompt and decisive attention, and further loss prevented, but the ten thousand-dollar per year inset leak had been going on for he knew not how long.

Another time, a manufacturer of grain harvesters, also a large land owner, took me to some of his fields to show him that it was this very same pest of the cornfield that was committing very serious depredations; clear enough to him after they were pointed out to him. He was advised of the one practical and thoroughly efficient preventive measure, that of a simple rotation of crop, and appeared to thoroughly understand the nature of the pest with which he was dealing and the measures to be applied in exterminating it. Being also somewhat eccentric, he appeared to rather over-estimate my own connection with the matter, but faithfully carried out my recommendations. As I afterwards learned, he rotated his corn land of that year with a crop of oats the following season, exterminating the corn root worm, but the army worm came that year and destroyed the oat crop, a combination of circumstances that neither I or anyone else could foresee. A year later, and after I had almost forgotten the matter, while walking along the streets of a neighbouring city, I suddenly felt myself in the hands of some one whose grip, and the weight with which it fell on my shoulder, might have been an Irish policeman from Chicago, but who proved to be my manufacturer friend. With a number of descriptive adjectives, by no means of an entomological character, he informed me that I was an ass, and that the corn insect that I said would be exterminated by a rotation of crop, instead of being exterminated had actually changed to something else, become more destructive, ruined his oats, and he thought the whole lot of blankety blank

entomologists ought to be exterminated instead of the insects. Keen as he was in his business as a manufacturer, as a farmer he had totally neglected to familiarise himself with the insect factor, which was costing him so much money, and did not know that the insect attacking the corn and the one attacking the oats had no relation to each other, and that their occurrence in his fields, following each other as they did was simply a coincidence, and that he had accomplished all that he set out to do under my direction. It is safe to say that nothing of this sort ever did or ever could occur in his shops, where factors of vastly less importance were considered and promptly acted upon with an intelligence to be gained only by the mastery of minute details. I give these illustrations to show that there is a sort of indifference towards insects and their ravages that does not appear in businesses other than agricultural pursuits, but, nevertheless, seems to be a sort of constitutional defect of the human race. This may be due to their minute size and the fact that, being insects and always with us, we become so used to them and their effects that we accept them as the less civilised do the winds and storms, heat and cold, elements that must be accepted as they occur and nothing done to control them or soften their influences. I have thus gone over these matters in some detail, in order to show the conditions under which the agriculturist labours, as relating both to insects and that which I might almost term superstitions relating to them and their ravages. Indeed, as one of my fellow entomologists has painted out, "well-informed men who put enormous stress on the fact that by certain processes they can save one-tenth of one per cent. in the butter fat in their milk, seem utterly unable to realise a loss of ten, fifteen, or fifty per cent. in the productive capacity of their pastures, meadows, and grain fields, as long as there is no total devastation.* After we have worked out the life history of an insect, found the vulnerable point, so to speak, in its methods of living and reproducing, found remedial and preventive measures that are effective and the application of which are entirely practicable, we still have to deal with the equally uncertain element, man's apparent apathy regarding insects, whether good or bad, and their relation to his financial interests. Those who are inclined to consider and act in such matters are frequently discouraged and hampered by those about them, and whose inaction will be sure to more or less counteract their efforts to control these insidious pests, and any measure of protection will be more or less defeated in its effects if it does not ward off attack from adjoining premises as well as destroy. An orchardist may spray his trees and kill every codlin moth larva that hatches on his own premises, before any damage is done, only to learn later on in the season that his neighbour has raised enough of the second brood of moths to invade his orchard and destroy his fruit, after he has himself protected it until the crop seems almost assured. A good spraying machine is a most valuable article on any farm, but if one were to start out to sell a really good article, he will be astounded at the number of farmers and fruit growers

* Proc. Soc. Prom. Agl. Sci., 24th Ann. Meeting, p. 37.

who have no use for them. It may not be out of place just here to call attention to the fact that the manufacturers of the $1·00 trap lanterns, a worse than useless invention, made a fortune out of the sale of them, in spite of all warning.

I have discussed these phases of the problem at some length in order to show its magnitude, as well as the difficulties with which its solution is surrounded. There never will be a time when we do not have to fight these pests—when eternal vigilance will not be the price of good fruit and profitable grain, grass, cotton, rice, or in fact any other crop. The scientific man may work out scientific problems; the experiment station may demonstrate the practical application of the results obtained, but of what avail is all of this if the husbandman does not himself put his shoulder to the wheel and help himself. If we are ever to reduce this annual tribute of $300,000,000, it is the agriculturist himself that will have to do it. He is on the ground; can see the situation exactly as it is; see hundreds of obscure but significent features of the problem that the man in his office or laboratory cannot observe; can note the inter-relationships between earth and air, between the animal and the vegetable, all as he goes about his fields. He sees Nature at short range, sees her as she is; in fact, he is transacting business with Nature every day. He is right out on the firing line and can see things as they are; is in the best possible situation to take advantage of the information furnished him by others. Not only this, but it is his own money that he is saving. Talk of cheapening the cost of production is all right enough, but we seem to lose sight of the fact that it costs almost as much to produce half a crop as it does a whole one, so far as labour and seed is concerned; and a crop of corn, cotton, hay or any other that has been injured from five to fifty per cent. by insect attack will cost the farmer or planter nearly, if not quite, as much as would a full crop, with no proportionate increase in prices, unless the trouble is of such a nature as to affect a vast area of country, thus preventing the supplying of the deficiency from a distance. We are not in the habit of looking at this $300,000,000 as so much added to the cost of production, and we even hear it said that insect pests are a blessing in that they prevent over-production and low prices, but it seems to me that if the American husbandmen could save even a large percentage of this loss, he might be the gainer, though prices might be somewhat lower. The loss of two or three million dollars in any one State, by the ravages of the Hessian fly, chinch bug, or cotton boll weevil, means that there will be that much less money brought into that section of the country, to circulate back and forth through the banks, as it flows through the various channels of trade. It means less business for the merchant and professional man, and less work for the mechanic and day labourer, and, if anything, increases the cost of his living. Wheat may be $1·00 per bushel and cotton $40 per bale, but what will this avail, in a community where there is little or none to sell? I mention these things to show the far-reaching effects of losses through the causes that I am discussing. The farmer feeds and clothes the world, and anything

that effects the products of his industry affects not only every kind of business, but everybody in any way connected with such business. I have now given you the basis for my discussion of the insect problem, as relating to agricultural pursuits.

Our destructive insects have been derived from two sources, viz., native species that have become adapted to the changed conditions brought about by the advancement of civilisation, and which may be subdivided into such, as, though native to the western hemisphere, have diffused themselves in a perfectly natural manner, more or less aided by the food supply offered by the crops of the agriculturist, and such as seem to have been established within our territory until they have become sufficiently specialised to offer little or no indication of their ancient home elsewhere; and such as have been introduced, accidently, from other countries, frequently in articles of commerce.

There are comparatively few destructive insects that have not come to us from other lands, either by natural diffusion or by artificial and accidental introduction. The several species of click beetles, parents of the wire worms, and the nocturnal moths, parents of the cut worms, the plum curculio, and a few others were here long before the white man, the two former inhabiting the cornfields of the dusky savage, and the latter breeding in the wild plums of the woods. Of the others which we cannot trace to trans-oceanic countries, nearly all can be followed to their ancient home in the equatorial regions. The cotten worm is a South American insect, probably having been diffused long ago, possibly largely by the aid of the winds, as the moths are found not only in central Ohio, but even in Ontario, Canada, occasionally immediately after a southwest gale. The cotton boll worm ranges over England, Central and Southern Europe, Central and Southern Asia, Africa, America, and Australia. The army worm ranges over Maderia, Southern Asia, North America, New Zealand, Australia, and is sometimes found in England. The codlin moth is found in England and Ireland, North and West Central Asia, North America, New Zealand, and Australia. The cotton boll weevil has come up from the south and crossed the Rio Grande River into Texas within the last few years. The harlequin cabbage bug did precisely the same thing 35 or 40 years ago, and we can trace the western corn root worm, the chinch bug, the striped cucumber beetle and their allies southward through Mexico into Central America, and there are many others of our destructive insects that have come to us by what may be termed natural diffusion, influenced, so far as we can now determine, by climate and an abundance of food. In fact, we come back to the illustration of the honey bee on a much larger scale, as these insects have passed and repassed the borders of nations as well as those of states, with never a hand raised against them.

Again, there are other insects that have been brought to our shores from other countries, and they, too, have found a congenial climate and an ample food supply. These have gained a foothold,

largely along the sea coasts and spread inland, those that have become established on the Atlantic coast far outnumbering those that have found a home on the Pacific coast. Some of these have thrived most wonderfully in this country, and have become among our most insidious insect pests. The codlin moth, the gypsy moth, the leopard moth, the clothes moth, the oyster-shell bark louse, the Hessian fly, the clover root borer and the clover leaf weevil, the asparagus beetles (two in number), the cabbage butterfly, the currant worm, the horn fly, the elm-leaf beetle, the willow curculio, and a myriad of others that have helped to swell this enormous annual loss to the country, first appeared along our eastern coast line. On the Pacific coast the scale insects, especially the notorious San José scale, the potato tuber moth, and some others have done their full share in the work of devastation; one alone, the cottony cushion scale of the orange, at one time threatened to wipe out the entire orange-growing industry along the west coast, and would probably have done so but for the fortunate introduction of its mortal enemy from Australia that put an end to its ravages. The Cordilleran Mountain system forms an almost impassible barrier to the eastward advancement of species introduced along the west coast, and the most of those coming to us from across the Pacific come from Northern Europe and Asia, and seem to have made their way across Behring Strait, into Alaska and then south and east. Quite a number of our species of insects can be traced back to their native homes in the eastern hemisphere by the course just indicated, and while some of them have remained confined to the Pacific slope, others have pushed broadly to the east and may now be found from Greenland southward into New England. The Appalachian mountain system to the east forms a similar barrier to the westward progress of species introduced along the Atlantic coast, except that there is a single gateway through which they gain admittance into the fertile plains of the middle west. This is along the southern shore of Lake Erie and between it and Lake Ontario, especially the former. It is within the portals of this huge gateway that we are now sitting, and species of insects introduced into the region about Quebec do not usually work their way westward to the north of Lake Ontario, but they first move to the southward, into New England and New York, then westward, entering Canada again between Buffalo and the mouth of the Niagara River. The cabbage butterfly followed precisely this course of diffusion, while the two asparagus beetles, first introduced much farther to the southward in the United States, have spread up through New York and crossed the Niagara River into Canada in the same manner. The willow curculio is following the same course, and there are many others that I have not time to mention. On our own side, the course of diffusion lays along the south shore of Lake Erie, across the north-west corner of Pennsylvania into north-eastern Ohio, where they spread broadly to the westward and to a lesser degree to the southward. Of the destructive insects that have travelled over this path of diffusion, one of the asparagus beetles, the willow curculo, clover root borer, clover leaf weevil, cabbage worm and still others might

be mentioned, all imported into this country from across the Atlantic. Thus we find that we can trace the path of diffusion of the most of our injurious insects either from distant portions of our own country or from other countries more or less remote, and having established themselves among us have come to stay; and the welfare against them is to be an every-year experience in future.

There are two powerful natural elements that exert a continual restraining influence on nearly all insect pests, and it is when one or the other of these become temporarily inoperative that we are likely to experience wide-spread devastations among such as have become fully established among us. One of these influences is adverse meteorological conditions and the other natural enemies, and they may be considered as regulating the abundance and destructiveness of insects by their direct influence on the pests themselves and also in the effects of the former upon the latter, for, adverse meteorological influences on the natural enemies of any insect pest is decidedly advantageous to that pest, as it is thus relieved of one of its most powerful restraining influences.

It is a mistake to suppose that severely cold winters are detrimental to insects, as, if the cold is continuous, the effect is to their advantage if anything. You can freeze an insect once, in the northern parts of the country at any rate, and it will thaw out in the spring as healthy as it was in the fall, whereas a repitition of this is fatal. Thus it is the open winters, as we call them, in the north that are the most detrimental, though this is probably not as essentially true of the warmer portions of the country. In the north, the farmer can take advantage of this phase of the insect problem in many ways, some of which are equally applicable in the south. Very many species in the late fall betake themselves to matted grass, heaps of rubbish, fallen leaves and like places for protection from the cold of winter; and, besides, the effect of such covering is to in a measure counteract the effect of sudden changes of temperature. A single warm, sunny day in early spring does not thaw the ground thus covered only to be frozen again at night, but rather serves to keep it continually frozen until more settled warm weather. The great lakes in the same way protect the peach buds in Michigan, Ohio, and portions of Canada. Insects ensconsed among this rubbish, or about the roots of vegetation growing there, are not subject to the full effects of the sudden changes that prevail in the open, but if the farmer takes the precaution to graze off this grass in fall or burn over these neglected areas during winter, he removes this protection and either kills the insects outright or else subjects them to the adverse effects of the weather. Again, the wire worms, cut worms, and grub worms, so disastrous everywhere to the Indian corn crop, feed upon the roots or lower stems of grasses until fall, when they burrow downward into the ground, not in order to get below the frost line of winter, but to reach a point where they will escape the freezing and thawing of fluctuating temperatures. When the farmer fall ploughs land infested by these insects just before winter sets in, he not only breaks up these

winter habitations, but throws up the ground, so that the frost penetrates deeper than it otherwise would, and is subjected to this repeated freezing and thawing that the insects have tried so hard to avoid. These three groups of insects breed naturally in grass lands, and in rotating from a grass to a corn crop they constitute the most destructive element in corn culture; but they can be met in a practical manner by simply fall ploughing these lands after they have prepared for the winter, when they become too torpid to prepare a second or to burrow deeper to escape the effects of a changed condition of the soil above them. If the farmer would but examine the cocoons in which many insects pass the winter, he would find that there is an inner wall and an outer wall, between which is a more or less open work of threats, thus forming an air chamber that counteracts the sudden and radical changes of temperature and moisture, and he can apply this information in his business by seeking to disarrange the domestic affairs of insect pests as much as possible, especially in the late fall, and let the weather do the rest. While on the subject of burning grass and rubbish, I wish to call attention to the fact that the various species of rye grass that grows so luxuriously along fences, ditches, and other waste places harbours myriads of the joint worms and straw worms that attack wheat, rye, and barley, doing very serious damage by causing the kernels of the grain to shrink and shrivel, resulting in a loss that not one farmer in one hundred, or perhaps five hundred, would suspect was caused by insects, and which might have been saved by mowing off this grass in late June or burning it off in winter or early spring. The farmer who fall ploughs his grass land is not only taking time by the forelock, so to speak, by getting his spring's work done in advance of the season, but he is fighting insects in the most practical manner possible and several kinds at the same time and with the same measures. This does not apply wholly to the northern farmer, as fall ploughing is one of the most practical and effective measures to apply against the cotton boll worm and the cotton boll weevil; while the burning over of waste lands in winter will, if anything, be more beneficial in the south than in the north, where we know it is of great value. Again, the modern wire fence is an important innovation from an insect point of view, as it requires a minimum amount of ground to grow up to grass and weeds, while the osage orange hedge and the Virginian rail worm fence the worst of all. It has been demonstrated in Iowa and Kansas, and is true elsewhere, that a hedge fence, with its outlying borders of neglected ground, is one of the greatest protections possible to provide for helping the chinch bug through the winter, and the worm fence is its full equal in that respect. When I tell you that I have traced an outbreak of chinch bug in a wheat field to the shocks of fodder that were allowed to stand over winter therein, you will understand the significance of a half-mile of hedge or worm fence. The plum curculio finds just the winter quarter that it desires in such places, and the same is true of many other insects. The farmer that fall ploughs and cleans up his premises in the fall or early winter is fighting insects

in the most practical manner possible, because he is not only dealing a terrific blow to his enemies in advance, but he is making the weather help him in his warfare.

The next practical method of fighting insect pests is by a rotation of crops, in itself a most excellent factor in good husbandry, but less applicable to the orchardist than to the farmer, though even the strawberry grower has found it advantageous to grow but one or at most two crops of fruit on the same ground, without changing for a year or two to some other crop. The fact is, Nature rotates her crops but rarely, and insects that, through ages, have been dependent upon them for food have come to hatch, develop, reproduce, and die in accordance with the growth, development, and death of the plants which they inhabit; the plants have become fixed in habits and location and so have they, and they cannot change in a day to meet the adversities that may be thrown in their way by the twentieth century up-to-date farmer.

The female insect that produces the cut worm, the female that gives rise to the wire worm, the parent of the white grub, the mother of the corn root worm, and the mothers of many other insects can only protect their offspring by placing their eggs where there is the greatest probability of an ample supply of food, and they can only presuppose the future by the present and past. These insects have been following a course for centuries, and cannot change to meet the requirements of a rotation of crop, which is, to the highest degree, unnatural and to them unlooked for. Therefore, if they deposit their eggs among the plants of their natural food, and the farmer suddenly displaces this with another upon which they cannot subsist, death is inevitable. Again, if on reaching the adult stage, the mother insect must undertake a long journey in order to find the proper food supply for her future offspring, there is more than likely to be terrible disasters awaiting her on the way, so that of the many that may set out on the journey there may be few that will reach the desired end. If the Hessian fly, the wheat midge, and any other equally frail insects, happen to emerge and are obliged to migrate during a storm or heavy gale the probability is that a very small percentage will survive the ordeal; whereas if they have not to go more than a few feet or yards, that is if they do not have to leave the field in which they originated, the casualties will probably be few. To such an extent do these factors enter into account with insects that in many cases the female is totally wingless, as is illustrated by the wheat straw worm, Isosma grande, one generation of which is wingless in the adult stage, the female of the canker-worm moth, the female of the strawberry crown borer, and we even have a form of the notorious chinch bug whose wings are so aborted that they are useless to the possessor. Of course, the weather at time of the emerging of winged adults of many species may be favourable to them, and they may be able to travel long distances, but the farmer or small fruit grower who forces them to do this, regardless of meteorological conditions, will reap great benefits from obliging such travels, as very often the weather will

aid him in his contest. Again, if a field of corn is badly infested by the corn-root worm, the mother insect deposits her eggs about the roots of the plants in September, with the expectation that the same kind of plant will grow up there another year; but the farmer changes the crop to one of the smaller grains, and what is the result? As soon as the young hatch the following June and attempt to feed they find no roots upon which they can subsist, and they are totally exterminated by starvation. If the Hessian fly, when it emerges in September or October, according to latitude, can find no wheat plants above ground, her progeny will die from lack of food, because they cannot survive on any other plant. Imagine the sensations of cut-worms, wire-worms, and the white grub when they go into winter quarters in a luxuriant meadow, and the few that do survive the weather wake up in a ploughed field with no food in sight! The farmer that rotates his crops is engaging the assistance of Nature in advance to help him in his conflict with insect pests. The stock raiser and dairyman do not like to rotate their pastures and meadows, but chinch bugs and bill bugs are compelling them to do so, for if allowed to revel in permanent pastures they soon begin to curtail the grass crop, and if it should be timothy grass they may soon kill it out entirely and migrate to others, for they seem to work the greatest injury in timothy meadows and pastures, whereas if these were subjected to a system of rotation this would not occur. I have known of instances when the short-winged form of the chinch bug was rendered practically harmless by a general rotation of the grass lands in a certain community. In the middle west, the underdraining of swamps and the bringing of these under cultivation, is coming to be a serious problem, as when the swamp vegetation is removed and replaced by corn, the insect inhabitants of these attack the corn plants and destroy them. The pests cannot breed in corn, and the second year they have disappeared, but thousands of acres of corn are annually destroyed in some states by attempting to grow it immediately after breaking up these reclaimed swamp lands. The remedy is not difficult to apply, and consists in killing out all of the swamp vegetation by fall ploughing, and the destruction of all stray plants early in spring, while the planting may be delayed until late in May.

Crop rotation is one of the most effective measures that can be applied against the Hessian fly, because it forces the frail adults to journey from one field to another many times when, owing to unfavourable weather, the most of them must perish on the way. By far the most practical and efficient measure is late seeding. This was first worked out and applied systematically by myself in Indiania, while in the employ of the United States Department of Agriculture, back in the '80's, but it has since been demonstrated from Kansas to the Atlantic coast that it is by far the most effective measure that can be applied, and that it is possible for any farmer, by watching the insect and the seasons, to so time his sowing as to have his wheat come up just after the flies have come and gone. The flies come forth from the stubble in which they have passed the summer at times varying with the latitude and

weather, the time being later to the south and earlier to the north, living but a few days and then dying. Thousands of wheat growers are taking advantage of this, and do not sow until the flies have disappeared; this, in the latitude of Chicago, will be about September 10 to 15, while in the latitude of Cincinnati it will be about the first week in October, but the exact time varies with the weather during the few weeks previous, the same meteorological conditions, that is lack of moisture, that will prevent the starting of the young wheat plants will also retard the appearance of the fly, so that every farmer must work out the problem of the proper time to sow wheat in the fall for himself and for his own neighbourhood. A warm fall extending into December, as it sometimes does, is favourable to the development of the fly, not that it increases their numbers at that time, but it enables a greater number of the young to become sufficiently advanced to pass the winter in safety, and the increase in numbers follows the next spring. This is why there are sometimes comparatively few in the fall and so many more in the spring, and a few early-sown fields will be sufficient to stock the whole neighbourhood where they are located. I say each farmer must here think and act for himself, because a few years ago we had the spectacle of a certain experiment station director going out just at the time when wheat in his locality ought to be sown, and, seeing a fly depositing its eggs, rushing off associate press despatches to a half dozen states, regardless of location, urging farmers not to sow their wheat and to plough up that already sown, when there was at that time no danger of Hessian fly, and the following year showed that there was no danger to be avoided, even in the field where the one female was observed threatening to devastate the country by laying a few eggs. By rotation of crop, thorough preparation of the seed bed, sowing at the proper time, and free use of phosphates, where commercial fertilisers are required, any farmer can ordinarily avoid the fly, but the thing that he cannot do is to prevent his neighbour disregarding all of these things and breeding fles enough to overrun the neighbourhood the following spring.

Generally speaking, there is usually some way whereby the husbandman can ward off insect attack upon his crops, but it is necessary that he first know what it is he wishes to overcome, next what to do, and do it at the proper time and in a proper manner. If these suggestions were followed that $300,000,000 annual loss would be greatly reduced. But so long as those engaged in the production of grains, fruits, and other agricultural products do not cultivate a business acquaintance with these pests, it cannot be expected that this enormous loss will be reduced, but rather that it will increase, if anything. It is of comparatively little use for the official entomologist to attempt to reach the masses direct; this must be done through the influence of representative farmers, such as I have before me. It is you that must take the initiative, and the rest will gradually follow. Insects go through their life cycle about as regularly as clockwork, and if you wish to hit them at any particular point in their life history, at least during the warmer months, you must be on time with your application; you must spray when

the proper time comes and not a week or two earlier or as much later, simply because you were too busy to do it at the right time. If you wait to see what an insect is going to do, the probability is that by the time you find out it will be too late to use your remedy. Remember that you can fight insects by good farming better than in any other way. The insect problem is a big one and must be handled as such, and not as if it were a small feature of your business. Their effect is so insidious that more than ordinary watchfulness is necessary in order to detect the leak and save the leakage by removing the cause thereof.

Twenty years and more ago there was an insect known along the Mississippi River as the buffalo gnat, that, during some years, killed enormous numbers of live stock of all descriptions, and sometimes a human being fell a victim to the pest. A single county in West Tennessee suffered a loss in live stock amounting to half a million dollars in a single season, and in Louisana 3,500 head of stock were killed in a single week in one parish. Acting under instructions from the Department of Agriculture at Washington, I spent a portion of three years investigating the trouble, and found out that it was primarily due to the fact that these gnats bred in the spring in running water, and an overflow of the river, at a certain time, enabled them to breed in millions in what was ord narily little more than a ravine. The levees were rebuilt and the old breaks in them closed up so as to prevent the influx of river water into the low or swamp lands, and there has been no serious trouble since. Formerly these insects were sometimes present in such numbers as to prevent the running of the horse cars in Memphis, but since the country along the St. Francis River has been protected from overflow by the new levee, the pest has not occurred in that country to any serious degree. I cite this last illustration to show the necessity of unity of action in fighting insects that range over wide territory. The individual can accomplish but little as compared with what might be done by concerted action. The codlin moth costs the state of New York several millions of dollars each year, and how many apple growers spray systematically and spray right? What is true in New York is true in New England, Ohio, and Illinois. Talk about taxation! Here is a tax paid every year that would cancel the entire interest-bearing debt of the United States in three years, and it is paid by the husbandman alone! We cannot prevent all of this loss, but intelligently-directed action will save an enormous amount, the most of which is now a total loss, largely through a lack of easily-acquired knowledge of the causes and intelligent application of the requisite measures of relief.

A GRAIN OF WHEAT:
Its Structure and Properties.

(By M. A. Cobb, in the *Sydney Daily Telegraph*.)

From time to time much has been written of the many ways in which the officers of the New South Wales Department of Agriculture are endeavouring to improve our main cereal crop, and to-day we give another glimpse into this field of activity, where science is fast ushering in novel ideas destined probably to exert a strong influence on future thought and practice throughout the wide range of industries connected with the growth of cereals and their conversion into food.

With the present generation of scientists and agriculturists there began a new and more profound investigation of the qualities of the various grains. These researches led to a clear perception, on the part of a few leading spirits, of certain fundamental needs. One of these needs, though not the one to be first seen or most clearly apprehended, was that of a better nomenclature of the numerous varieties of grains. A vast amount of valuable time was spent on the scientific examination of grain before it was fully realised that it was being largely wasted because of defective nomenclature, and because of the loose agricultural and commercial practices resulting therefrom. For example, it was of comparatively little use to conduct researches upon a sample of grain which could not be duplicated on account of being a hopelessly mixed sample, or a sample without name and status. Unfortunately a large amount of such work was done in many parts of the world before its defective foundation was perceived.

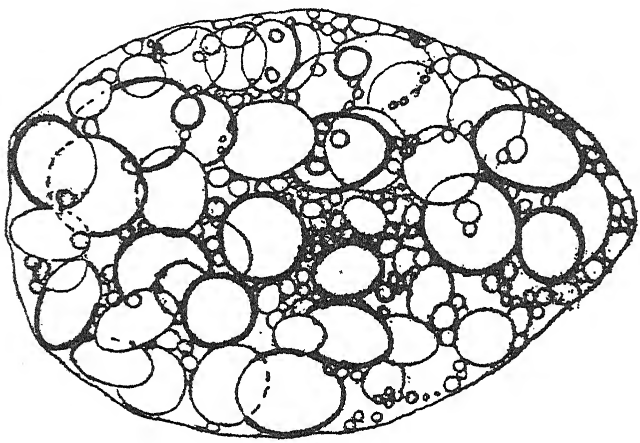
In the study of the varieties of wheat the New South Wales Agricultural Department has taken a prominent part. At one of the most fruitful of one of the Wheat Rust Conferences, that held in Adelaide in 1892, the officers of the department moved for the appointment of a wheat nomenclature committee, and, as a result, an Australasian committee was appointed. This committee worked industriously for several years, and the consequence was that the foundations of a definite system of Australian nomenclature were laid, and the consistent use of this system by the State Governments of Australasia has proved of unquestionable value.

The extension of a similar system to other parts of the world, and especially an elaboration of the system that would give greater reliability in the classification of samples of grain as they are presented in the market, is now receiving attention. The investigations take the form of a careful study of the structure of the wheat grain. This, perhaps, seems to be a small field of investigation, but

a visit to the scene of the investigation reveals endless vistas of speculation along which the researches may proceed, and a hundred unsolved problems, the answer to which must have far-reaching results that will affect every person who eats bread. It may appear to be a far cry to the dinner-table from that mysterious-looking network of protoplasmic matter under the microscope; but in the light of scientfic inquiry the two become almost identical in some respects.

Biological Analysis.

The results already obtained have received much attention. "In the beginning," says Dr. Cobb, the pathological expert to the New South Wales department, "it became necessary to invent methods of examination, and from this arrived the promulgation of



Sketch of a flour cell magnified several hundred diameters. The small bodies of varying size shown in the cell are the starch granules, of which there are several hundred to upwards of a thousand in each flour cell, and from 19 to 20 millions in each grain of wheat. Each flour cell contains, in addition to the starch, all the other elements of flour. Hence upon an understanding of the flour cell depends the rational solution of very many of the problems of making and using flour.

the system of biological analysis. Mr. William Farrer, the well-known breeder of wheat, the results of whose experiments were recently noticed, writing on the difficulties that beset the work of improving wheat through selection, said in a paper read before the Australasian Association for the Advancement of Science: 'In this dream of mine I have seen that there are difficulties in the way, and that before we can make any considerable progress in improving the quality of the grain of the wheat plant, we shall have to devise a method of making a fairly correct quantitative estimate of the constituents, and notably the glutenin and gliadine in the grain of a single plant, and yet have seeds left to propagate from that plant.' The need thus clearly set forth has been keenly felt wherever wheat breeding has been undertaken, and the biological analysis meets this need. It has been reviewed and discussed in technical journals

abroad, and has received the approval of high scientific authorities at the head of the most noted British and American experiment stations. In the course of the biological analysis the grain of wheat is taken to pieces somewhat as a watchmaker takes a watch to pieces, and each of its biological constituents is accurately determined. The process can be carried out upon a single grain. The difference between this method and the ordinary process may be well stated by saying that in the ordinary process the mill tears the grain to pieces, while in the biological analysis the grain is taken to pieces. The difference is much the same as that between the watchmaker's examination and an attempt to examine watches by first grinding them in a mill. It is needless to say that the watchmaker's examination is that best calculated to throw light on the real nature of a watch."

During the process of biological analysis, the separate cells of which the grain is composed are dealt with in an individual manner if desired, and this is frequently done. To see the cells thus handled and ranged up together is to realise how novel are the conceptions introduced by this new method. In the first place, it is seen that the portion of the grain of wheat that is relied on to produce practically all of our ordinary flour is composed of cells that are all of one class.

The Flour Cells.

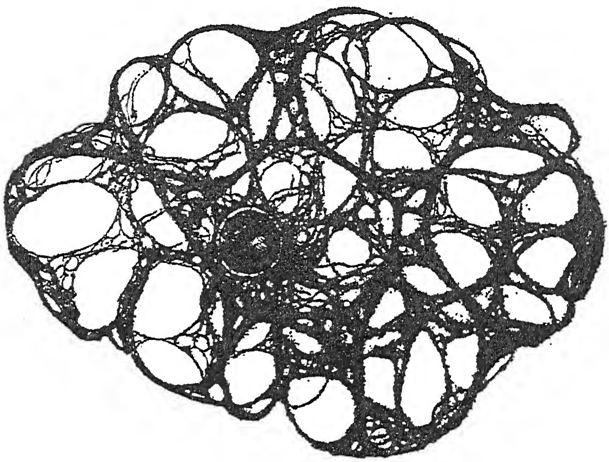
These are called the flour cells, and in each of the cells are found all the elements of flour. With this fact established, it is possible to enter upon a further phase of investigation. The problem of milling in its ultimate essence is contained in the flour cell. "This," Dr. Cobb claims, "is a new and more accurate conception of the aims of a great industry, and it does not require a prophet to see that in future our thought and practice must focus upon this cell as an individual. We have gone a step deeper and found a new and better and more elementary idea. On the very rare occasions on which any thought has been given to that phase of the question, flour has been looked upon as a dead substance. Nothing could be more distant from the truth, for, in point of fact, flour, as it issues from the mill, is living matter."

Every flour cell has all the common constituents of the living cell, and all are in a living state—each in its proper position, and re-acting as living matter. "There is," Dr. Cobb proceeds, "the protoplasm with all its complexities, the nucleus with all its directive possibilities, there is the starch and the soluble portion, together with a limited amount of water. We are accustomed to speak of the seed as having a suspended vitality, but this is only a rough approximation to the truth. The fact is that its cells are living and have indeed accomplished only one-half of their intended life. The other half is connected with the transference of their material to the embryo as needed. The seed, therefore, has its living activities, and, though these are not as rapid as those of ordinary plant cells,

it is impossible to point out any other essential difference. Their rate of life is retarded, not suspended, as we ordinarily say, for if the seed be kept dry it goes on living for a number of years, according to the kind of seed—for some ten years in case of the wheat grain—and then dies.

'A DISTINCT FALLACY.'

"This, of course, is a well-known fact, but little thought has been directed to the manner of its death, which is very gradual and not sudden. If from time to time we test seeds from a sample of a given year, we shall find that, though for a time germinative power is not rapidly diminished, before very long it begins to perceptibly



Sketch of a flour cell after the removal of the starch granules. This network in the flour cell is living matter—protoplasm. The somewhat massive nucleus is shown near the centre of the cell. The fact that this network and nucleus constitute the gluten of wheat throws a flood of light on what we may now call the biology of flour, and explains the changes in the amount and nature of the nitrogenous components of flour as it ages.

decrease, as shown by the smaller percentage of germination and the weakness of the resulting plants, until at last it ceases altogether. This is conclusive evidence of the continued activity of the cells in the seed. The vital processes continue, though at a diminished rate, as compared with ordinary green tissues, and we may say that the seed gradually 'runs down.' In all these properties the flour cells participate, and for this reason still possess the nucleus and all the other necessary mechanism of the normal living cell. A clear light is shed on this matter by the researches under review. Now the literature of milling is widely permeated, or at least that part of it that deals with the structure of wheat grain, with the idea that the interior of the wheat grain is simply a collection of 'starch cells,' as if the fact it is aimed to express by that word was its chief characteristic. This is, however, a distinct fallacy. The chief characteristic of the interior part of the wheat grain referred to is

that it is composed of flour cells which are in every sense fully equipped living cells, each containing all the elements of flour."

The Maturing Process.

So much for the seed—the wheat grain. In flour, these same flour cells may be obtained, though in limited number if we seek for unbroken individuals. Fragments of flour cells are the main element of flour; indeed, they constitute practically the whole of it. Each of these fragments repeats the properties of the living flour cell to a large extent, and is actually alive, though when once separated from the other parts of the cell to which it belonged it is

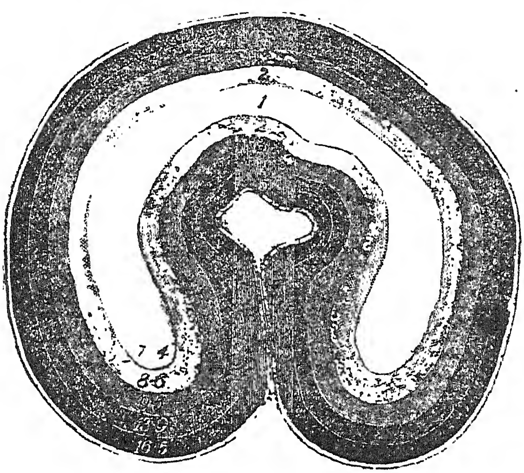


Diagram of a cross section of a grain of wheat of the Purple Straw type, showing the location of the five arbitrary "concentric" zones or layers of flour removed by hand. The "core" is shown white, and each successive zone is shown in a darker shade, the outermost zone being represented black. Outside the zones the bran is represented as a narrow white layer. The five zones are numbered 1, 2, 3, 4, 5, and are successively thinner toward the outside of the grain. The percentages of gluten found in the flour are marked on each zone. Zone 1, 7·4 per cent.; zone 2, 8·6 per cent.; zone 3, 9·5 per cent.; zone 4, 13·9 per cent.; zone 5, 16·5 per cent. The diagram is drawn to scale.

no longer able, on the access of moisture, to function as it was intended to do. But this does not keep it from being living matter, and subject to death. The particles of flour die in much the same manner as they would in a dry stored seed, the main difference being that the process is accelerated by the freer access of air. All living matter has the property of resisting its own destruction by the aid of its own living forces. Thus it happens that the particles of flour require some time to die, a process concurrent with the maturing process.

A Triumph of Modern Biology.

A further study of the flour cell by methods specially devised to suit the case has disclosed the nature and the distribution of the

gluten. By special processes the flour cells are isolated and "fixed" as the biologist phrases it. This fixation and subsequent staining is described as one of the greatest triumphs of modern biology. When in a living condition the various elements of the cell are not easily observed owing to various difficulties, one of the chief being that all the constituents are more or less transparent and colourless. Add to this that they are so small as to tax the utmost powers of the microscope, and are always in a state of change, and it will be readily seen that observation is a difficult matter. All these motions on the part of the cell contents take place according to the most exact laws. The figures of a dance are not more precise and elaborate than those gone through in the interior of a cell.

But, in spite of all the intricacy, the skilled biologist "fixes" a cell, and by this method it is possible to deal with the living flour cell so as to bring its elements under scientific review. "When this is done," Dr. Cobb explains, "it turns out that gluten is protoplasm. Spread through the cell as an elaborate network in which is suspended the nucleus of the cell, and in whose meshes the starch granules are held, this protoplasm repeats most of the features familiar to botanists in the ordinary living plant cell. This is one of those stimulating facts that will form the basis of new investigations, because it at once suggests a number of new and rational theories as to the true nature of an important foodstuff, and enables us to bring to our assistance a vast accumulation of biological knowledge relating to the nature and composition of protoplasm."

The results of these researches have a practical significance, for all the facts secured in the course of the investigations are being utilised towards the purpose of the work, which, as has been explained, is the improvement and extension of the classification of wheat from a commercial standpoint. It is generally admitted that, while our present methods may be in many respects the best that our knowledge allows, they are still far from satisfactory. It is further to be borne in mind that, though the new points that have been emphasised in this article are more or less incidental to the investigation, they are nevertheless valuable, and, as is often the case in research, they are almost as important as the main end sought. They are, indeed, complete results in themselves.

GRADING AND PACKING FRUIT AND VEGETABLES.

(Continued).

The bulk of fruit grading will, however, be mainly concerned with variations in size provided the essentials of good form and freedom from defects be secured. It is of the utmost importance to ensure that each grade be as uniform throughout as close attention can accomplish, and then the full value of the work is most likely to be obtained.

A quick eye and some practice under good guidance soon enable a packer to select the various sizes in a uniform manner. Apples in particular can be readily graded into several sizes according to the variety and the crop. Occasionally four well-marked grades may be obtained, in other instances perhaps three are secured, and sometimes only two are obtainable. The difference of a quarter of an inch in diameter will constitute a well-marked grade. An American Association has adopted as the minimum standard for first grade apples of the largest types $2\frac{1}{2}$ inches diameter; while for the smaller types $2\frac{1}{4}$ inches is the minimum diameter for first grade fruits; in each case a $\frac{1}{4}$ inch is allowed between the firsts and seconds. In practice it is found almost impossible to adhere to such exact grading; the general standard and range in size of the crop or variety must be judged, and the graduation founded upon this. These remarks especially refer to apples for cooking, or dessert apples equally well coloured, but what has been already said about the value of colour must be remembered and a special grade selected of uniform size where there is a proportion of larger fruits deficient in that respect.

Most of the details regarding apples are also appropriate to the grading of pears, but as a larger proportion of these are used for eating than cooking, they are more adapted for disposal in small packages, and hence repay the greatest attention in uniform grading. Several qualities can usually be obtained from one crop, and it generally pays best to sell in two or three grades, only those rejected in the selecting process being disposed of in bulk. Even when large crops from old orchard trees are being dealt with, a few dozen of the finest fruits carefully packed will help to raise the total returns considerably.

Stone fruits may be selected in various grades. Plums for cooking can thus be sorted into two or three grades, the largest fruit commanding the best market. A good medium size is in demand for bottling, and the smaller sizes are utilised in ordinary cooking or preserving. Dessert plums and cherries are readily graduated on the same method, the finest in boxes or small packages and the others in bulk.

Soft fruits, such as strawberries and raspberries, are worthy of equal care, the former being sorted into at least two grades and sometimes into more. The best are placed in punnets, the next in small boxes, and a third grade can be sold in boxes or baskets holding from 6lb. to 12lb. Raspberries may be conveniently divided into two qualities whenever a special sale can be commanded for the best fruits either in punnets or small boxes.

Nearly all other fruits also admit of some grading, even though it be only to the extent of excluding defective and malformed specimens; the results yield a satisfactory reward for the labour and expense.

The benefits derivable from careful and systematic grading are by no means confined to fruits, as vegetables also afford considerable encouragement to those who strive to make the most of them in the same direction. Especially is this the case with root crops, though in a general way the sorting adopted is of a very rough character. Potatoes, for example, are usually picked up in three sizes, the large tubers for sale, the seconds or sets, and the small tubers to be used as food for stock. The large size should be again sorted into two or three grades; it is with them, as with apples, a comparatively small proportion of coarse, irregular tubers spoils the appearance of a large consignment. Even shape and uniformity of sample possess a distinct market value, and a medium sized potato having these characteristics, together with good quality, will bring a better return than huge distorted tubers of which size is the only recommendation. If an extra 6d. per bushel or £1 per ton can be secured by such care it often means, with a good crop, sufficient clear gain to more than pay the expenses of cultivation.

A distinction can be made between the best or earliest turnips and carrots and the ordinary quality or crop in bulk, by marketing the former in bunches, while the latter are sent in bags or baskets. Onions, too, can be graded in several ways, the best being bunched or made into "ropes," while smaller sizes are sold loose, the smallest ranking as pickling onions. It is always advisable to have several sizes, each sample fairly uniform, as some buyers have a preference for medium size bulbs and others for large ones. In selling small quantities by weight the retailers have a difficulty with the largest onions, and usually find the medium size more convenient. If roots are prepared for sale by being thoroughly cleaned it is a great help, and in any case wherever grading is followed all the best qualities should be so treated or the chief part of the labour will be nullified.

Pease and beans should always be graded. Yet this is seldom done by the grower, and, as with many other vegetables, it is usually left to the retailer. Large, well-filled pods of the former are always in demand, and if the colour is good their value is enhanced. But they are too often gathered without due care, and a number of insufficiently developed pods materially lower the value of the whole, while reducing future gatherings. Two or three

grades of pease can be readily formed, according to the condition of the crop and the varieties, some being much more even croppers than others. In supplying consumers direct, daily or at regular intervals, it is now becoming the practice to shell the peas, grade them by means of sieves, and consign to the purchaser in small boxes. Dwarf kidney beans and scarlet runners can be graded by selecting the long, straight, and even pods for the best samples, in smaller quantities, the bulk going for sale in bushel or half-bushel baskets.

With green vegetables, such as cabbages, savoys, kale and Brussels sprouts the principal point is to see that each sample is uniform and in the best condition, which is largely a question of care in gathering. For ordinary markets the first two named must be large and with solid hearts; for special sale and for sending direct to consumers a smaller size, but possessing all the other essential characters, is often preferable. Brussels sprouts should always be sorted into two grades, all the firmest and most compact into one, and the looser, rougher sprouts into another; the increased price of the first will pay for this in the majority of cases. To cauliflowers and broccoli similar remarks apply; the most even and whitest heads constitute the first grade, the rougher and discoloured the second. As with cabbages, large heads are required in general markets, but for the best sales moderate-sized perfect samples are the most satisfactory.

Other crops pay for attention in the same way. Rhubarb can be classed in two grades, the longest, straightest and best coloured forming No. 1 bundles. Celery may be divided into two or three grades, the heaviest and most solid in bundles for salad, the others loose for soups. Asparagus, too, should be placed in two or three grades, according to the length, substance and blanching; the smallest (Sprue) for soups; all the best in bundles of 25, 50, or 100, the last in larger numbers. Seakale can also be sorted, the best grown and whitest in bundles set upright in baskets.

Tomotoes demand the greatest care in sorting; two, three and even four grades may be formed. The best in boxes or shallow baskets. The most even and brightest coloured fruits take the lead; there is a special demand for the largest, handsome fruits in some markets, but the principal general sale is for good even-shaped, moderate-sized, uniform samples. Cucumbers are graded into two or three sizes; and vegetable marrows are also sorted, but in some places large specimens of the latter are most in demand, while in others a medium size is chiefly required.

Salading, like lettuces and endive, can occasionally be separated into two grades, according to the solidity and blanching of their hearts, but as a rule a uniform sample of one value is preferable, to be regulated by the gathering.

The essential general rules in grading vegetables of all kinds are the following:—(1.) Exclude all immature, overgrown, coarse, or defective specimens from the leading grades. (2.) Make each

grade as uniform as possible. (3.) Let freshness and fittness for use be the characteristics of all vegetables when consigned to market or consumers. To aid in all this only the best varieties obtainable should be grown, and growers should watch closely for every real improvement on old sorts.

Packing for Sale.

Wherever fruits or vegetables have to be transferred a distance by road or rail, the best culture and most careful grading may lose all their value through neglectful packing. That many of the defects in market consignments are either due to this or materially increased thereby the majority of salesmen can confirm, and the complaints on this score are as frequent as those regarding inattention to grading. In dealing with fruits the essentials for success are as follows:—(1.) Use only perfectly sound fruits. (2.) Pack firmly, without crushing. (3.) Use the best elastic odourless materials as packing. (4.) Place all choice and ripe fruits in small quantities and shallow packages.

In the home trade baskets are much more extensively used than boxes, and the most common are round baskets without lids, of the bushel, half-bushel, or half-sieve types. They are strong and durable, but are objectionable for all the best fruits, as even with the most careful packing, the top layers are liable to be bruised, and under careless methods they are certain to be damaged. When apples, pears, plums, cherries, or gooseberries are sent in such baskets a covering of paper, with straw or other material, is placed on the top and secured by cross pieces of willow or hazel, the points of which are forced through the sides of the basket below the rim. Flat baskets with lids are preferable but expensive, and the difficulty with all these is that they must be charged for or returned. In extensive dealings with market salesmen baskets are supplied at very little cost to the producer, but where it is desired to promote more direct communication between the grower and retailer or consumer some other method is preferable, or the producer must provide his own baskets. It would be helpful in many districts if a local industry could be developed in cheap basket making; there are few places where suitable willows could not be grown, and the basket making might be performed in the winter evenings.

Much could be said in favour of boxes for fruits, and, where only small sizes are employed, they may be purchased or made so cheaply that they can be included in the price of the fruit, and thus all the trouble of returning or collecting empties is avoided. Their more general use under the right conditions would assist producers to avoid overstocking the markets in seasons of heavy crops, and, by facilitating direct communication with the consumers, secure better prices. In a small way, boxes can be made at home at a cost of 1½d. to 1s. each; on a larger scale, with the use of machinery, they may be turned out at about 8s. to 50s. per 100, according to the size, and boxes costing 1d. to 6d. can always be given with the best grades

of fruit, usually even with profit. Many of the leading railway companies have recognised this fact, and now supply boxes of various sizes at 1s. 6d. to 5s. per doz., while several manufacturers also supply to large orders at very reasonable prices.

Various materials are available for packing purposes, but much the best are the several grades of wood wool now prepared, the coarsest being suitable for large packages and heavy fruits, and the finest softest samples for the choicest and ripe fruits. But whereever it is to be in contact even with apples and pears only the softest make should be employed; the rougher samples can be used for the bottom, or filling up at the top. All choice and delicate fruits should be encircled with bands of folded soft tissue paper, having a glazed surface, which must be in contact with the fruit. This is also required to place over the top layers, but a stronger paper is used for unripe apples or pears.

In the actual work of packing, an even layer of wood wool is placed at the bottom of the box or basket, this being covered with a sheet of paper, and upon it the fruits to be disposed of are placed firmly. The best plums, pears, or dessert apples should never be in more than two layers, and in the smallest boxes holding one layer they travel in the finest condition. If only one layer of fruits is made, the packing material at the bottom, and that at the top, besides the folded paper band round each fruit, will be all that is essential; but if there are two layers, they must be separated by two sheets of paper, and sufficient fine wood wool evenly spread to prevent injury to the lower fruits, and form a firm bed for the upper ones to rest upon. From one dozen to four dozens of the best dessert apples, pears, or plums may be so packed in one box with safety for a long journey. Peaches, nectarines, and apricots must always be in single layers, and demand the utmost care.

Strawberries can be packed in from 3lb. to 6lb. of selected fruits, but the first-named quantity is the best for the finest fruit, and the smallest of the railway boxes just holds that amount conveniently, allowing for a little packing material at the top and bottom. The same size box will hold 4lb. of best cherries, 3lb. of raspberries without their stalks, 3lb. red currants (closely packed), or 4lb. of black currants; but the last two may be packed in 6lb. to 12lb. lots if not too ripe; the smaller quantities are, however, preferable and safer. The finest early strawberries should be packed in 1lb. punnets, which may be either deep or shallow, round-plaited chip punnets, or square ones (with or without handles). The round punnets are best packed in trays with lids, and those generally employed will take six punnets. They are only used for the earliest and choicest fruits, when prices are good. Crates can be employed to hold several such trays, those large enough for six being a convenient size and weight. The square punnets are packed more closely together on sliding shelves, or in trays like the others in crates. Grapes are packed in shallow or handle-baskets, the points of the bunches towards the centre and

the stalks secured to the sides or rims, the top of the basket being covered with stout paper tied round the rim, or some handle-baskets are fitted with lids. The sides and base of the baskets are sometimes padded, but they are then always covered with a soft glazed paper. The great point is to avoid rubbing the surfaces of the berries and spoiling the "bloom."

In every case, besides ensuring the security of the finest fruit, it should be displayed to the best advantage, and if the grade is uniform, as advised, this can be done quite honestly by the aid of a little coloured or white tissue paper to fold over the sides when the box is opened, and by arranging the fruits with the coloured side uppermost.

The question of branding or labelling must be considered, for where good fruit only is being dealt with, the use of the words "Seconds" and "Thirds" is apt to give rise to a misconception that is unfairly against the seller's interest. For the finest samples "Extra," "Select," or "Special" may be employed. Some mark the next grade A1, and the next No. 1, or if the letter X is employed, three would be used for the first grade, two for the second, and one for the third. Another method is to term the best Selected No. 1, and the other grades Selected No. 2 and Selected No. 3. Something of this kind is needed to indicate that the lower qualities are not refuse but properly graded fruits. A grower should adopt a uniform system, and adhere to it, so that his brand may become known and have a market value, and every package ought to have the name of the variety and quality boldly printed on the label. Growers who intend to make a substantial business, and whe deal honestly in the best produce, should have their own names on the packages. This is sometimes objected to in a market, but if a grower cannot make his business through the ordinary channels he must try fresh ones. It is best to endeavour to supply the shopkeepers, or to develop a trade with private customers, and send direct to them. The reduced rates at owner's risk on the railways, and the parcels post, afford ample means for enterprising men to work up a business in small packages of choice fruits if they take the trouble to do so, either by advertising, by circulars, or by trade letters.

In packing vegetables most of the general advice already given should be serviceable; but these are disposed of in larger quantities and therefore require a different class of packages. Bags of various kinds and sizes, with large light open baskets or crates, are more extensively employed than boxes. The majority of roots are sent in bags, but the best samples of turnips, carrots, etc., that are bunched are sent in crates, while radishes and small roots are sent in baskets. Green vegetables, like cabbages, are best in crates, as also are broccoli and cauliflowers, but the earliest and best of the last named are often packed in flat baskets or hampers and pay for every care. The best samples of salading, such as lettuces, are usually packed in hampers, the rougher grades in crates. Pease and beans are packed in baskets, bushels, or half-sieves, but as previously noted pease

when shelled are forwarded in small boxes containing about three quarts each. Half-sieves are also used for Brussels sprouts, pickling onions, and other small vegetables. The earliest rhubarb is consigned in hampers; the later often goes to market in bundles loaded direct into the vans, or packed in crates, as also is celery. For all early and high quality vegetables shallow baskets or boxes are useful. Cucumbers, tomatoes, mushrooms, and many others can be conveniently sent in this way, and where periodical consignments of general vegetables are sent to private customers, this is the best method. It is necessary to pack firmly as with fruits, and where green or perishable vegetables have to travel a long distance it is desirable to gather them as shortly before packing as possible, preferably in the early morning, when quite fresh, but not when drenched with rain. They should not be allowed to remain exposed to sun or wind for some hours before they are sent off, as is sometimes the case, to the obvious disadvantage of the seller. Defective or decaying samples should on no account be admitted into the packages; the uniformity so strongly recommended as regards fruits should be maintained, and it will be found that the reputation gained is a satisfactory reward for the extra care.—[*Leaflet No. 98*, from Board of Agriculture, England.]

OUR MILK SUPPLY.

The following report has been taken from the columns of the *Morning Herald*. Considerable controversy has arisen over the matter, and it is to be hoped that some definite action will be taken in the near future:—

The recent outcry against the constant heavy mortality amongst infants has promoted an inquiry into the causes which have led up to this loss of life, and amongst other things attention has fallen upon the milk supply of the community. There are many who regard the inferior quality of the milk as being in a large degree responsible for the loss which the country bewails, and although there is frequent evidence that the health authorities are active in endeavouring to prevent a too liberal use of the pump, it is claimed that this is not a sufficient precaution to insure the health of the juvenile population. At any rate, this view is held by Mr. A. Crawford, the Acting Director of Agriculture, who for many years filled the position of State dairy expert.

"The prevention of adulteration with water," said Mr. Crawford yesterday to a *Herald* interviewer, "is not by any means the only consideration which local boards of health should entertain. So far as the health of the community is concerned, that is the least important evil to be guarded against. I have watched carefully the

prosecutions in Perth and Fremantle for adulteration of milk, but up to the present I have not heard of any instance of milk having been analysed with a view to the

Detection of any Preservatives

which might be present. The adulteration with preservatives is far more prejudicial to infantile health than any dilution of the milk with water. Travelling about the country at different times, when in my former position as dairy expert, I was often asked by dairymen what was the best kind of preservative to use for milk. In most instances I strongly urged them not to use any preservative at all, but to chill the milk immediately after milking, and by so doing it would last at least 12 hours longer than if simply put in the cans and sent away. I also found that some dairymen, both in the town and the country, were using preservatives of different kinds. That most used is one composed of boracic acid and borax; and other people are using preservatives containing a considerable amount of salicylic acid.

Injurious to Child Life.

From reports prepared by medical men in England and America, who have made a special study of milk for domestic purposes, it seems to be the unanimous opinion that so far as child life is concerned, both of those preservatives are injurious, salicylic acid particularly so, and I cannot help thinking that as so many of the children in this State die from stomachic disorders, a very considerable portion of them die as a result, directly or indirectly, of the preservatives put in the milk. I can quote one instance which actually came under my own notice. Before the milk was sent away from the farm a preservative was added in order to keep it sweet—if anything, a greater quantity than was recommended by the manufacturers of that particular mixture. When the milk was received by the retailing tradesman, he, not knowing that the milk had already been fortified, added a still further dose of the preservative. When that milk was delivered to the hotels and restaurants, the already double allowance was further added to. The consequence of this is that very often anybody getting a glass of milk can distinctly taste the preservative in it."

Where Local Boards Fail.

Then you advise action by the Local Boards of Health?

"Yes. Where I think they are failing to cope with the difficulty is in not having the milk analysed to see whether it is adulterated with borax, boracic acid, salicylic acid, or formalin. I feel convinced that a very large proportion of the milk retailed in summer time is so adulterated. I believe that on the continent, in the United States, and Great Britain the use of all kinds of preservatives is absolutely forbidden so far as milk intended purely for

domestic purposes is concerned, although a small percentage of borax or boracic acid is allowed to be added to butter. I do not think that there is any law on the West Australian Statute book, nor has any regulation been made by the Board of Health, forbidding the use of these preservatives, and I consider that a regulation, or an Act, if necessary, should be introduced to absolutely prohibit the use of any preservatives whatever in milk."

STERILISATION.

How will that affect the metropolitan milk supply?

"Well, if the supply immediately around Perth is not sufficient to cope with the demand, and if the people in the country cannot manage to send the milk to the city in good condition, the other alternative is to either pasteurise or sterilise the milk. So important has this process been considered in regard to the rearing of children, that in the United States and Great Britain the local town councils have actually undertaken the provision of sterilised milk for children, and in the Eastern States the use of sterilised milk for domestic purposes is very rapidly extending. The Windermere dairy, near Melbourne, which started in a small way a few years ago, has now grown to very large proportions. I have no doubt that if more attention were paid to the pureness of milk, independent of its adulteration with water the mortality amongst infants in this State would be very considerably reduced."

THE USE OF ACID PRESERVATIVES—DR. BLACKBURN INTERVIEWED.

The views expressed in our columns yesterday by Mr. A. Crawford, the director of Agriculture, on the subject of the adulteration of milk and its responsibility to a great extent for the loss of infant life, are concurred in by Dr. Blackburn, the Government bacteriologist and acting president of the Central Board of Health.

"A little while ago," said the doctor to a *Herald* interviewer yesterday, "I discussed with Mr. Mann, the Government Analyst, the subject of carrying out a systematic examination of foods generally, and in this manner going a good deal further than the local boards do. Dr. Black, the president of the Central Board of Health, has now set the matter in motion again, and requested the Government to provide Mr. Mann with additional assistance to enable him to cope with the extra work that the varied analysis will entail."

You agree that the use of preservatives is highly dangerous?

"It is, of course, but I should not like to say that in this State the employment of preservatives in milk is the cause of the heavy infant mortality. I think that for some time now the public have been refraining from using fresh milk to the extent that was formerly the case. The preservatives may, however, be found in the tinned milk, but not to a great extent."

Would you favour the sterilisation of milk?

"Of course, but that is a big matter to deal with. The erection of a considerable amount of machinery would be involved."

What foods is it intended to analyse?

"Everything that is tinned; also milk, raspberry vinegar, lemon syrup, wines, etc."

POULTRY FARMING AS AN OCCUPATION FOR WOMEN.

By a Correspondent.

The great success of Lady Warwick's hostels in England has made a few women in Western Australia anxious to see a hostel started here. For £60 or £80, a thorough training in horticulture, bee-keeping, poultry rearing, and landscape gardening can be obtained at one of Lady Warwick's very successful hostels. It is thought that a grant of land might possibly be made for this purpose by the Western Australian Government; funds could be borrowed, and a thoroughly trained teacher could be imported from England. The success of Lady Warwick's hostels is said to have come largely from the great care taken in the selection of suitable students. It is not every woman who has a vocation for farming. A love of rural life, and animals and plants is necessary, also a certain amount of intelligence, and what is vaguely called "business ability." That some women are admirably suited to become small farmers has been proved in various parts of the world. "Women love detail, men hate it," said a lady farmer not far from Perth. Certainly women have more patience than men, and that fact is, perhaps, at the root of her rather sweeping statement. Men want to start on a large scale. Women are satisfied to begin with very little, and creep up gradually to what men think should make a beginning. Hence poultry farming seems to be a most suitable employment for women who like a quiet, independent, domestic life. A woman whose idea of happiness is to be waited upon, to dress smartly, and to pay calls on her neighbours would never be happy on a poultry farm; but one who loves to rise with the sun, breathe plenty of fresh air, and have her children constantly "for company," would not change a poultry farm for any town existence.

At Hill Crest, Victoria Park, a lady who knows Lady Warwick's hostels and their advantages has, in three years, made a decided success as a poultry farmer. She started with six ordinary fowls. Then she bought, for £7, three Wyandottes from Mr. Oneto, of Cannington. She has bred up from that small number of cocks and

hens 400 fowls, and her stock is a valuable little property at present. Hill Crest is an interesting place to visit. The farm house, standing on a hill, is surrounded by bush, and might be a hundred miles away from Perth; the stillness is only broken by the lowing of cows, or the fierce bark of a watch-dog. Blue parrots and an occasional hawk are the principal visitors. Trees and the distant hills are, in the opinion of the lady farmer, pleasanter to look at than chimneys and slate roofs. Besides, her time is fully occupied. At half-past 6 every morning, whether the sun shines or the rain falls, or the wind blows, she must feed her feathered family, and from that time until 10 o'clock she has only a few spare minutes for a hasty breakfast. The first meal given to the fowls is a mash of pollard and bran, stale bread is sometimes added. This breakfast is spread on old pieces of sack, as the sand would otherwise spoil the appetites of the cocks and hens, and injure the chickens. It may be remarked here that food for fowls is now only about one-half the price that was demanded for it a few years ago, and this reduction in pollard, bran, and wheat has greatly assisted the poultry farmer, fresh food being almost unprocurable in the vicinity of Perth. The market, meanwhile, has remained "splendid." Eggs and poultry are in greater demand than ever, and high prices rule everywhere.

After breakfast, all the little drinking troughs are carefully cleaned and filled with fresh water. Cleanliness is a necessity in poultry farming, and here the patience of women is said to make them superior to men, for a woman will visit each little pannikin and fill it many times in the day, while a man will not notice when the fowls upset their water, and will leave them parched with thirst all day, if they are stupid enough (and fowls have little intelligence) to jump on their drinking cans and water troughs. At midday green stuff is given to the fowls. The evening meal consists of wheat. A good supply of shelled grit and powdered egg-shells is distributed. If a fowl or chicken looks out of sorts, it is separated from the rest of the family at once, and carried to the fowl hospital, where a little sulphate of iron often puts it right again. Liver disease is more difficult to cure: but with good and regular feeding the fowls suffer from few complaints.

Milk is excellent for fowls; and during the three years at Hill Crest the lady farmer has added to her stock two cows and six calves. All the surplus milk goes to the cocks and hens and the chickens; and to milk she attributes a great deal of their good health and plumpness. Another matter of very great importance is when fowls sleep. Hill Crest, which was laid out as a poultry farm, abounds in trees. Instead of sleeping in houses, the fowls roost in the trees. A good deal of squabbling goes on at bedtime, each fowl having its own particular favourite branch; but all go happily to sleep at last. The lady farmer thinks to this natural shelter she owes the fact that no fowl on the farm has ever suffered from tick. Fancy breeding and the table are combined at Hill Crest. The Wyandotte is reared for fancy purposes, and fifty handsome young cockerels, valued at a guinea each, strut about in

one wire pen at present. For table purposes, the Wyandotte crossed by Minorca is considered excellent; and sixty of these young cockerels are doomed to death in another wire pen. Close by is a silver Wyandotte cockerel, progeny of fowls that took prizes in the Perth Poultry Show in 1903. In poultry-yard language, he promises to be "a beauty." All the silver Wyandottes offered for sale are the progeny of prize fowls; but this especial bird, who has a wire pen to himself, is something unusual, even in a silver Wyandotte. Indeed, this breed of fowls becomes for the time being the one and only breed worth talking or thinking about, so enthusiastic is the lady farmer about her Wyandottes. They have taken many prizes, and will, no doubt, take more, for an elaborate process of weeding out weaklings and doctoring drooping chickens goes on. The fowls are watched with great care, and the only pang the lady farmer feels is when a chicken pie stands on her own table. She could eat a bit of duck, but never, never a bit of a silver Wyandotte.

The Wyandottes are good, if not the best sitters; and if you start with a healthy strain, to rear chickens is not at all difficult. A pen with 50 small chickens, taken from their mothers at the tender age of six weeks, testifies to the healthiness and activity of these nursery inhabitants. The reader will have noticed that to have many wire pens is absolutely necessary on a poultry farm. Eighty mixed pullets, Wyandotte and Minorca crossed, for egg production, are in a pen beside the little chickens. Then comes a pen in which are 12 Wyandotte pullets that commenced laying at the age of three and a-half months. Further on are twelve silver Wyandotte cockerels, which are all developing "the right way" for breeding purposes; and so on until the whole 400 fowls have been accounted for.

"The great mistake, it seems to me, poultry farmers make, is to expect rapid results," said the lady farmer. "I have been farming for three years. The first year I lost 2s. 5½d. The next year I covered all expenses and made £2 8s. The third year I cleared £50, after paying all expenses. This year, with my increased stock, I shall make a great deal more. Under three years one must not look for a profit. Of course, I have had much to learn. That is why I so earnestly desire to see a hostel started in Western Australia. There is a great opening here for poultry farms, especially small farms, that women can work themselves; but the woman who goes into this business must be prepared to work herself. If she employs too much labour, especially at the beginning, wages will run away with the profits. I think women are very well suited for poultry farming. A woman who begins as an amateur learns as she goes along, and, in time, becomes thorough. Besides, it is a healthy life for the children, a satisfying way of passing one's time, and it helps to build up the State. I think poultry farming by women should be encouraged by the Government; and I hope one day to see here a hostel like Lady Warwick's famous schools for women agriculturists and farmers in England."—*West Australian.*

THE POULTRY INDUSTRY IN 1903.

By Edward Brown, F.L.S.

The maker of a well-known patent medicine adopts a most striking advertisement showing the number of his pills which are taken annually. The result works out at four hundred and thirty-two millions—a quantity which is almost incredible. The brain reels at such figures. But, comparatively, both in respect to number and size, they form a mere bagatelle in face of the fact that for every one of these pills swallowed there are yearly consumed in Great Britain ten eggs, and that last year the total weight of the last-named product used on this island was no less 250,000 tons—enough, one would think, to make omelettes for the entire community many times over. But it is only in the aggregate that these figures astound us. Below I give the *pro rata* consumption, from which it will be seen that the capacity of the British appetite is by no means overtaken. A proportion of these eggs are used for manufacturing purposes. I have endeavoured to estimate how many, but have not succeeded in the attempt. One firm uses at least a million per annum, and its product is not for food. Probably not more than 5 per cent. of the quantity named is employed in purely manufacturing purposes. It is difficult to give approximate figures as to the poultry consumed annually in Britain, but taking home and imported produce, I estimate that the weight of poultry of all grades eaten would be last year about 65,000 tons. Thus adding eggs and poultry together we have a total of 315,000 tons of hen-fruit eaten and used in this country. In a later paragraph will be found particulars as to imports and total values.

Very disappointing in many respects was the season of 1903, both during the time of hatching and of growth. Eggs in many cases were infertile and germs weak, and the cold weather made rearing more difficult, more especially with delicate races, and the period of longer days—for it could scarcely be called summer—did not improve matters. In spite of these drawbacks production has undoubtedly advanced, and the records received from all parts of the country tell of more and better fowls, and that farmers are more than ever recognising the value of poultry-keeping, and increasing their output, although there is much yet to be done to advance the supply of winter eggs and of spring chickens. Eggs have been, for the better qualities at least, higher in price than in previous years. How far this is due to increased demand or to better organisation in marketing is uncertain. Probably both have had their share in the result. The extended use of portable houses, a necessity where development upon farms is desired, is evident in many districts of England, but it is surprising that this system in other countries, in Wales and Scotland, has not secured general adoption. The one direction in which progress cannot be reported is in respect to turkey breeding, which has not grown in accordance

with the market demands. Again the supply has been very deficient, both at home and abroad, and prices have advanced for first-class specimens to an extent never known previously. During my visit to Italy last April I learnt that young turkeys were very scarce, and the shortage of supplies then anticipated has proved correct, so far as that country was concerned. Farmers living on lighter soils and in favourable districts would find the raising of turkeys a profitable pursuit.

In many parts of the country establishments are springing up upon extensive lines, where breeding and rearing are carried out on a scale not hitherto attempted. In so far as the principles of stock raising as recognised with other animals are observed—that is, the linking of stock-keeping with some form of cultivation—these appear to succeed, but they are to some extent in the experimental stage, and we must await their full development. In every case, however, it is important that twice—or, better still, three times—as much land should be occupied as required for the poultry to ensure rotation, and the land be cropped to the best advantage. One most remarkable development which has passed the testing point is the hatching and sale of young chickens. Several places are in operation where 20,000 birds are sold annually, and thus farmers and others who do not go in for incubators, or lay themselves out for early breeding, are able to secure early-hatched stock at the minimum of cost. This branch is only in its infancy, and there is no reason why several places should not be found in each county. Such a development would have been impossible before artificial hatching was brought to its present success. Incubators are a prime necessity to every progressive poultry-keeper, and their use is increasing very rapidly. Hatching houses with a capacity of one thousand eggs or more are becoming quite common. But the most noticeable recent advance has been in respect to artificial rearing. A better understanding of this subject, more especially the necessity for exercise, has enabled breeders to avoid the loss which at one time appeared inseparable from rearing artificially on a large scale. Brooder houses are now in use in which a thousand chickens may be seen at one time.

English county councils have provided teaching in poultry-keeping for several years, and where special instructors are employed have continued this work. But one effect of recent developments has been to distract attention from technical to primary education, probably, however, a temporary change. In Wales arrangements are now in progress for taking up the subject, and Welsh-speaking teachers are being trained with the object of utilising them in rural districts. Scotland is also going steadily forward in several counties, but there is plenty of scope for progress. Ireland has continued to make the greatest advance, and a large number of counties are now provided with teachers. The premium farms are gradually disseminating better fowls, and it is a pleasure to note that advantage is taken of the opportunity thus afforded, and that some of the ideals with which I first attempted to stimulate

better methods in the Green Isle fifteen years ago are now in process of realisation. In spite of many difficulties and much discouragement marked progress can be recorded, and in respect to this industry the future is most promising. Complaints are still rife as to the way in which produce is marketed, where older methods still prevail, but the work of the Department of Agriculture and the Irish Organisation Society is seen in several directions. I am glad to say that a beginning has been made in experimental work, which I have advocated for years, though as yet on very limited lines, both in England and Ireland. Notably is this the case in Cornwall, Hampshire, Lancashire, and Yorkshire in England, and under the auspices of the Irish Department of Agriculture, and the leaflets issued by the Boards in London and Dublin respectively are very valuable aids to poultry keepers generally.

Co-operation is making progress among producers, somewhat slowly in Britain, more rapidly in Ireland. In connection with the National Poultry Organisation Society we find that the opening of a depôt in any district insures better returns as a result of improved methods of marketing, and though there is much prejudice to overcome and many difficulties to surmount, the adoption of this system is only a question of time. It is part of a great movement which, rightly guided, will greatly improve the position of our rural community. But the country people must be educated up to a knowledge of the principles of co-operation, and be prepared to work out their own salvation by combination for mutual benefit. It is here where the custom of generations fights against us. A serious factor is the system of selling eggs and butter together. Pressure is brought to bear upon farmers by threats that if they sell their eggs to co-operative depôts the butter will be refused. These threats are seldom carried out, but they retard progress. During the later months of 1903 I have spent several weeks in Devonshire, where large numbers of eggs and chickens are marketed, but where the methods are yet on old lines. As an instance of an antiquated system, it was mentioned at the Devon County Conference, held at Exeter in October, and which was attended by the Earl of Onslow, President of the Board of Agriculture, that in some of the Devon markets eggs are taken by the dealers from producers, and the price is chalked up at the end by the former, regardless of what sellers may wish or think. Under these circumstances it is scarcely surprising that Devon eggs are frequently sold in London at the same price as Italian, and that in some places they fall as low as 26 for a shilling. Consumers have under present conditions no guarantee as to source of origin or of quality, and what is known as "blending," *i.e.*, the mixing of foreign with home supplies, is very prevalent.

My intention was to call special attention to the question of railway rates, but inquiries now being made are incomplete, and I must reserve dealing with the subject to a special communication. This is not the place to discuss the fiscal problem now before the country, but it must be pointed out that the poultry industry, worth

to the producers of the United Kingdom nearly ten millions pounds sterling per annum, has been built up on cheap food.

There would seem to be no limit to the growth of imports from abroad, for again the Trade and Navigation Returns, just issued, show a considerable increase for 1903 over 1902. Below we give the values for the last three years:—

	1901.	1902.	1903.
Eggs	£5,495,767	£6,308,985	£6,617,619
Poultry and Game ...	980,757	1,059,044	1,203,086
Totals ...	£6,476,524	£7,368,029	£7,820,705
Increase over 1900 ...	£60,054	£951,561	£1,404,237

The increase in 1903 over 1902 is £452,676, of which eggs are represented by £308,634, and poultry and game by £144,042.

In respect to eggs the most important direct increases are from Russia and Denmark, showing advances of 1903 over 1902 of £356,667 and £282,294 respectively, but the total increase of imports from the first-named country are not so great as here represented, for German supplies, which are largely from Southern Russia, show a falling off of £266,064; reductions are also recorded from Belgium and France, and a slight advance from Canada, and a larger growth from other countries. The total number of eggs imported during the last three years from foreign countries have been:—

1901	2,048,735,400
1902	2,271,661,560
1903	2,381,867,640

which, it should be remembered, are exclusive of Irish supplies. The average consumption of foreign eggs during last year was equal to 64 per unit of the population of Great Britain, and, allowing five to each family, the average expenditure was nearly 18s. per household in Great Britain for foreign eggs alone. It is satisfactory to note that it is proposed to secure, if possible, the place of origin for imports, and not merely to credit the last country through which they pass, a change which I have advocated for years.

The aveage values of the foreign egg, as stated in the Returns, are as follows:—

1901	6s. 5¼d.	per great hundred.
1902	6s. 7½d.	„
1903	6s. 8d.	„

showing a steady advance, in spite of increasing supplies.

The average values for the countries enumerated for the last three years are as follows:—

	1901.	1902.	1903.	
Russia... ...	5s. 4½d.	5s. 7¾d.	6s. 5½d.	per gt. hund.
Denmark ...	7s. 8¼d.	7s. 9d.	8s. 6¾d.	„
Germany ...	6s. 0¼d.	6s. 5d.	6s. 5¼d.	„
Belgium ...	6s. 3d.	6s. 3½d.	6s. 4½d.	„
France ...	7s. 8½d.	8s. 6½d.	8s. 4¼d.	„
Canada ...	7s. 3¼d.	8s. 1d.	7s. 10d.	„
Other countries	6s. 5¼d.	6s. 2d.	5s. 11½d.	„

The remarkable feature of these averages is the advance of Danish, which now take the position so long held by French, and the fall in Russian and Canadian.

In respect to poultry and game the figures are:—

	1901.	1902.	1903.
Russia	£180,750	£218,459	£324,087
Belgium	234,135	281,063	275,173
France	229,586	225,284	254,888
Other countries	336,286	334,238	348,938
	£980,758	£1,059,044	£1,203,086

Here we find Russian supplies have nearly doubled in two years, and possibly to a greater extent, for South Russians are doubtless included in "other countries," which ought certainly to be subdivided; and there are increases all along the line, except from Belgium, or rather Italy, but that was to be expected.

The total consumption is difficult to estimate, but I make an attempt in that direction:—

	Eggs.	Poultry and Game.	Totals.
Foreign produce	£6,617,619	£1,203,086	£7,820,705
Irish "	1,900,000	400,000	2,300,000
British "	4,600,000	2,700,000	7,300,000
	£13,117,619	£4,303,086	£17,420,705

an industry which represents annually the sum of £9,600,000 sterling to the producers of the United Kingdom, and of nearly £17,500,000 to the consumers of Britain, and which deserves the attention of all who are interested in the national welfare.

The Motor Cultivator to make British Corn-growing profitable, and the Harvest safe in Wet Seasons.

The harvest of 1903 is not calculated to give encouragement to corn-growing as at present practised in England. In addition to foreign competition and the low price of grain, many farmers, from no fault of their own, have been powerless to contend against the wet season, and a large proportion of the corn crop, in these cases, is rotting in the fields, or has been stacked in a much damaged condition. Yet corn-growing is a necessity, yea, a three-fold necessity

with us; for, like all the world, we need bread-corn in a daily increasing quantity; and in this climate stock-feeding cannot be carried on without arable farming; which, again, is impracticable, as a general system, without the intervention of white crops. Apart from the latter necessities altogether, it is time that the people of this country disabused their minds of the idea that it is cheaper to import bread corn even than it is to grow it. Beyond a doubt our farmers can still grow corn against the competition of the world by adopting a mechanical agriculture; and the same system will largely discount the risks and disadvantages of our humid climate, by making harvest operations the work of a single day on any given field, instead of a matter of weeks or of months, as has been too common an experience this year. Not that the progress of mechanical agriculture has hitherto been small in some directions. Far from it. The self-binder alone has already effected an enormous economy in the harvesting of corn crops. Still, in this one direction even, it will be seen that we have not yet utilised machine help to anything like its profitable limit. In the ordinary practice of corn-growing at present, a two-horse binder cuts at most 10 acres a day, at a cost, for cutting and stooking and binding twine, of about 4s. an acre. Carrying, stacking, thatching, and threshing up to 17s. 2d. an acre. The same work can be done by a motor-harvester, which will reap and thresh at the same time, at a cost of not exceeding 9s. 4d. an acre. Here are the comparative figures:—

COST OF HARVESTING AND THRESHING TEN ACRES.

1.—*By Ordinary Methods.*

	s.	d.	s.	d.
Cutting and stooking			25	0
Two horses and machine binder ...	9	0		
One man driving	4	0		
Three men stooking	12	0		
Binding twine			16	6
Carrying Sheaves			43	0
Two men pitching	8	0		
Five men carting	20	0		
Five horses and carts	15	0		
Stacking			22	0
Two men building	8	0		
Two men pitching	6	0		
Two men dressing ricks	8	0		
Thatching, at 1s. 6d. per acre			15	6
Threshing, 50qr. at 1s.			50	0
Total cost of ten acres			172	0
Cost per acre			17	2

2.—By Motor-Harvester.

	s.	d.	s.	d.
Cutting and threshing			39	6
Motor-harvester, one day	12	0		
Petrol and lubricating oil	13	6		
One motor-man	6	0		
One man at sacks	4	0		
One man at straw	4	0		
Binding twine			16	6
Carrying threshed corn and straw ...			30	0
Motor-wagon, one day	8	0		
Petrol and lubricating oil	8	0		
One motor-man	6	0		
Two men loading and unloading ...	8	0		
Stacking straw			8	0
Two men stacking	8	0		
Total cost of ten acres			94	0
Cost per acre			9	4

By motor-harvesting and motor-wagon, eight men reap and thresh and carry and stack 10 acres a day, at a cost of 9s. 4d. an acre; by ordinary methods the same work requires four men and two horses cutting, seven men and five horses carrying, six men stacking, three men and two boys thatching, and 10 men and two horses threshing—in all, one day's work of 30 men and two boys and nine horses—at a cost of 17s. 2d. an acre; a difference of 7s. 10d. an acre in favour of motor-harvesting. Besides this saving in money, there is the great saving in time, and securing the crop against bad weather, which means everything in a season such as this. How much has been spent this harvest on restooking and trying to keep the sheaves on end?—and all in vain. How many ricks have been damaged by rain after the corn has got the length of the stackyard? and how much more damage will be done to these ricks by over-heating and by rats, mice, and birds, before the corn is threshed in the spring? A very good authority, Mr. John Speir, estimates that one-third of the grain crop of Scotland is damaged this year. And for the whole of the United Kingdom it is probably well within the mark to say that 1,000,000 acres have been utterly ruined. All this loss and waste might have been avoided by reaping and threshing at one and the same time; there would have been no damaged corn; the sample would be brighter and sweeter than if threshed from the stack, and worth at least 1s. per quarter more on that account; while grain threshed on the field weighs 1lb. per bushel heavier than from the stack, which alone is an increase of nearly 2 per cent. No arguments which it is possible to advance against the reaping and threshing at one operation will weigh for one moment against its many advantages.

But this is not all. The motor-cultivator will effect as great a saving in the cost of corn culture as in reaping and threshing. With horse labour, the average cost of corn cultivation, taking all kinds of corn, after clover or roots, cannot be put at less than 12s. 10d. an acre for ploughing, drilling, or sowing, harrowing, and rolling; whereas the motor-cultivator or plough, with seeder and

roller attached, will do the whole in one operation, at a cost of 5s. 8d. an acre. Let us now see how the total cost of corn-growing will compare under the two systems :—

	Ordinary Method. Per acre. s. d.	Mot. Cultivation. Per acre. s. d.
Cultivating and seeding	12 10	5 8
Reaping and threshing	17 2	9 4
Total cost per acre	30 0	15 0

There is thus a saving of exactly one-half, or 15s. an acre, by motor cultivation. On the British corn crop of 8,500,000 acres this would be a clear gain of £6,375,000. To the above costs, per acre, add for rent and taxes, say, 30s., and for marketing 4s. in each case, and it makes the total cost of the corn crop £4 5s. an acre by ordinary methods, and £3 10s. an acre by motor-cultivation, which, with an average yield of 40 bushels an acre, would be equal to 2s. 1½d. per bushel and 1s. 9d. per bushel respectively. With the cost reduced to 1s. 9d. per bushel, there is hope for the British corn-grower yet, notwithstanding low prices, foreign competition, and all the other drawbacks. It rests with British farmers themselves. The great bonanza wheat farmers of Dakota and California, whose experts have largely controlled the prices of corn in this country during the last 20 or 25 years, cannot put their wheat in the sack at less cost than 1s. 9d. a bushel; and we have the great advantage of the home market. Though the prices of both overland and ocean freights have fallen of late years, these still amount to about 4s. a quarter on corn coming through the Atlantic ports, and to 5s. a quarter on corn from Argentina exported to the United Kingdom. This is not a very large margin in our favour; still, it is equal to 20s. or 25s. an acre; and, taken in conjunction with the greater number of bushels grown on an acre of land in this country, is more than sufficient to wipe out the difference between the rent of corn land here and in the countries which send us corn. What is true of corn is true of every other crop grown on the farm. There are even greater possibilities for the motor in potato culture than in corn culture. And motor-cultivators can be made of all sizes to suit the market gardener or small occupier, as well as the large farmer, with prices proportionate. Moreover, by a slight interchange of parts the same motor will cultivate and seed the land, reap and thresh the crop, and carry it to market; also do other haulages, and stationary work, such as grinding, chaff-cutting, churning, pumping, sawing, or will drive a dynamo for electric lighting. The system of mechanical agriculture, which is here in part briefly outlined, is not a mere paper contribution to the subject. It has been tried in part, with every promise of ultimate success. Its evolution has, indeed, proved difficult, slow, and costly beyond all anticipation; but after five or six years devoted to consistent experiments in this direction, and to designing and building machines to do the new work required of them, I say, with all confidence, that there is nothing propounded in this article which I cannot safely undertake to do against another harvest.—*Scottish Farmer.*

SOIL INOCULATION.

Cultivation of Microbes.

In this issue we publish an interesting article on Soil Inoculation by "Bruni," taken from the *Australasian.* This throws still more light on a subject that is proving of value and worthy of research, and which has been given a fair amount of space in the *Journal* of late :—

"Surely the most curious circumstance connected with the practice of agriculture is the discovery of the fact that the British farmer has for a long course of years been unwittingly a breeder of earth microbes as farm stock. Many years ago it was noticed that cereal crops gave a better result if grown after certain other crops, and thus, in all probability, resulted the practice of a rotation of crops. It was noticed that certain leguminous crops carried nodules on their roots, and it was surmised that the presence of these nodules had something to do with the improved growth of the succeeding crop. Modern science has explained the cause and effect of these nodules, and the knowledge thus obtained has led to the establishment of the Solani system of agriculture in Southern Europe, of which I lately made mention. Mr. J. Golding lately contributed an interesting letter to the *Field* on the subject of the microbes that form nodules on the roots of leguminous plants, in which he makes the following remarks :—' But it is a tax on our faith in the oneness of nature and in the adaptability of living protoplasm to believe that a microbe measuring less than one twenty-five thousandth part of an inch in length is also so capable of response to outside stimulus as to undergo modifications rendering it worthy of the name 'domesticated.' Not only is this minute being entitled to the term, but it should rank high up in importance among those domesticated higher forms to which the science and practice of agriculture owes its very existence.' The actual introduction and cultivation of the earth microbe has been carried out by American farmers. On several occasions it was found that soil which to all appearance was admirably adapted for growing lucerne produced poor plants, and it was noticed that they carried no nodules on their roots. To remedy this, earth was taken from a lucerne field in which the plants grew luxuriantly, and this was sown over the land where the lucerne had failed. The result of introducing the earth microbe into a soil in which it did not previously exist proved a great success, and the result was a fine growth of lucerne.

Their Life History.

In the letter referred to Mr. Golding gives the following description of the life history of the microbe :—' The first stage in the life history of the organism which can be studied is when these

tiny specks invade the root hair of a leguminous plant. They then form into 'bacteria sacs,' or 'invasion threads,' long snake-like bodies, something like a tiny sausage-skin stuffed with these very small microbes. These invasion threads pass from cell to cell of the now modified root hair, forcing their way between them, and in some cases down into the root itself. This stage ends the invasion of the attracted wild microbe. The invasion threads grow larger, burst, and occupy the now enlarged cells of the nodules with microbes. These now appear to grow as simple rods or bacteria, and to increase rapidly by division. Even at this stage they give little or nothing to the plant; but the microbe is entering upon what is so often the first stage of domestication, namely, that of a parasite, in which it is modified by feeding, and is provided with a home. The rods now become longer, and finally branch, forming the so-called bacteroids, organisms which are sometimes five or six times as long as, and proportionately broader than, the parent wild form. The shape of these branched forms is peculiar to the nodule of the special plant in which it grows. There is more difference between these forms and the wild forms from which they spring than between any domesticated plant and its wild progenitor. This difference is made manifest by a simple microscopic investigation, showing the comparative size and shape of the two organisms. Recent research by Dr. Buhlert and others tends to establish the unity of species of the nodule organisms of leguminous plants; but it is also certain that they become modified, so that not only the shape is peculiar to the particular plant, but, further, they have not the ability to at once form healthy nodules on a plant which is not very closely related to the kind by which they have been domesticated.' "

REGULATIONS FOR SUPPLYING WIRE NETTING TO SETTLERS.

(Under Part IV. of the Rabbit Act, 1902.)

1. Applications under Part IV. of "The Rabbit Act, 1902," shall be made in duplicate in the Form A of the Schedule hereto, addressed to the Minister for Lands.

2. Notice by the Minister to the applicant of the cost of the wire netting, and of the amount of the annual charge upon his holding, shall be in the Form B of the Schedule hereto.

3. No application for wire netting will be granted until an inspector has examined the land which it is proposed to enclose with rabbit-proof fencing, and has reported upon the same.

4. No netting shall be supplied for the purpose of attaching the same to any existing fence until the inspector shall have reported upon such fence as to its suitability for the attaching of such netting.

5. The applicant will be required to produce satisfactory evidence of his title to the land and to execute a mortgage in such form as the Crown Solicitor may approve, and to pay the cost of the preparation and registration thereof.

6. The wire netting shall be of such quality as the Minister in the public interest, may think fit.

7. The fence to which the netting is to be applied shall consist of posts, strainers, and at least four wires, or three wires and a top rail. The posts to be not less than four inches in diameter at the small end; of sound timber, placed not less than 21 inches in the ground, and not more than 12 feet apart. Strainers to be not less than six inches in diameter at the small end; of sound timber, placed three feet in the ground, and not more than 128 yards apart. The netting to be attached to three wires, the top one of which is to be 36 inches above the ground, and the other two wires to be about 22 inches and eight inches above the ground respectively. The netting to be sunk below the surface of the ground perpendicularly six inches. The use of plain or barbed wire above the netting to be optional.

8. Every rabbit-proof fence for which netting has been supplied by the Government must be erected to the satisfaction of the Chief Inspector, or an officer acting on his behalf.

9. No quantity of netting less than two miles will be supplied to any applicant.

10. No netting will be supplied for the purpose of subdividing a holding into paddocks.

11. Interest at the rate of Four pounds per centum per annum will be charged upon the actual cost of the netting, delivered at the nearest railway station or shipping port, as and from the date of the completion of the mortgage; and will be payable half-yearly on the 30th day of June and the 31st day of December, in each year.

12. The cost of the netting as aforesaid will be repayable by half-yearly instalments, extending over a period not exceeding twenty years; the first payment to be made on the 30th day of June, or the 31st day of December, as the case may be, next following the date of the completion of the mortgage.

13. The mortgagor may, at his option, repay the whole or any portion of his liability at any time during the currency of his mortgage.

14. The Government will be under no liability for failing to deliver, or for any delay in delivery of netting.

THE SCHEDULE.

Form A.

THE RABBIT ACT, 1902.

Application for Wire Netting.

To the Hon. the Minister for Lands.

I [*or we*] of [*address*] being the owner [*or occupier*] of the undermentioned land, do hereby make application to be supplied with [*state quantity*] of wire netting, for the purpose of fencing the boundaries of the said land as hereunder described.

Signature..
Date...

Land on which netting is to be used: [*here insert name of holding, and refer to Crown Grant, certificate of title, lease, or license under which land is held*].

Description of boundaries to be netted, and whether the netting is for an old or a new fence: [*here insert description of boundary or route along which netting is to be erected, showing rough plan of same, and, if the netting is required for a fence already erected, state age of such fence*].

Netting to be delivered at [*state railway station or port*].

Form B.

THE RABBIT ACT, 1902.

Notice to Occupier or Owner.

Referring to your application of the......................., addressed to the Honourable the Minister for Lands, I hereby give you notice that the cost of the wire netting applied for by you, amounting to [*state quantity*], for use on the holding called [*name of holding, etc.*], in the district of.............., ...Division, delivered at the [*state name and "railway station" or "port," as the case may be*], will be [*state amount*], and upon receipt of the mortgage upon your interest in the said holding, duly executed in duplicate in the form herewith, securing the repayment of the cost, with interest, the netting will be forwarded at such times as may be mutually agreed upon.

(Signature)..
Director of Agriculture.

Perth,................., 190 .

Form C.

THE RABBIT ACT, 1902.

Certificate of Fence being Rabbit-proof.

This is to certify that the wire netting fence, containing [*state number*] miles [*number*] chains, situated in [*here insert name, locality, and description of run or holding, and refer to grant, certificate, lease, or license in which the holding is included*], and protecting the land at present occupied by [*here insert name of occupant*], has been duly inspected, and found to be rabbit-proof.

(Signature)..
Chief Inspector, Rabbit Department.

(*Date*)..........................

Form D.

Certificate of Appointment of Officer.

THE RABBIT ACT, 1902.

Perth,........................., 190 .

I,.......................................the responsible Minister of the Crown for the time being administering the Rabbit Act, 1902, hereby certify that [*insert name of Officer*] has been duly appointed a [*insert title of Officer*] under the Act.

(Signature).......................................

Minister for Lands.

NOTE.—Description of wire supplied is as follows:—Width, 42 inches; mesh, $1\frac{1}{4}$ inch; gauge, 17; price, £24 10s. per mile, plus cost of delivery to the nearest railway station or shipping port.

THE CODLIN MOTH.

Professor C. W. Woodworth, speaking at the State Fruit Growers' Convention, said:—"During the past summer quite extensive operations have been under way in the Pajaro Valley for the control of the codlin moth. These activities were brought about by the action of the Pajaro Valley Orchard Association, who obtained from the supervisors of Santa Cruz and Monterey counties an appropriation amounting to $2,500; Santa Cruz county subsequently made a second appropriation of $250, and these amounts were supplemented by the further sum of $175 subscribed by individual orchardists. This money was placed under the control of the experiment station to pay the expenses of conducting an exhaustive study of this insect. The desire was expressed that this work should include a careful testing of all the various means that have been suggested for the control of this insect, and in order that this might be done on a large scale many of the growers about Watsonville placed the spraying operations of their orchards under the control of the investigators. Our purpose was to so arrange the work that we could give quite definite directions for the control of the insects another season. At the same time it was desired to accomplish as much as possible during the current season in the control of the pest, without, however, sacrificing the experimental work.

"The work was under the immediate control of my first assistant, Mr. Clarke, and several advanced students from the entomological department also rendered valuable aid. The mass of data accumulated as a result of this work is too large to present at this time,

but will be given in detail in bulletins to be issued by the experiment station. I will only attempt to detail a few observations upon this insect which are among the more important additions to our knowledge of the habits of the insect. No insect has been studied more extensively and exhaustively than the codlin moth, but it appears that we are still far from knowing the insect as intimately as could be desired. One point in its life history which remained for a long time entirely unknown, was the egg-laying habits of the moth. The commonest conception, and the one which is still found in many of the books on entomology, was that the egg was laid at the blossom end of the apple at about the blooming time, but curiously enough this statement was made without a particle of actual observation to support it. I need not go into the details of the steps in the discovery of the egg-laying habits and the changes made necessary in the theories regarding the reason for the effectiveness of spraying with arsenicals.

"In the Pajaro Valley this season the moths did not begin to emerge in numbers until the fruit was of considerable size, and early in the season the eggs were not laid upon the fruit at all. It has been known for some time that many codlin moth eggs are found upon the leaves as well as the fruit, but no observations previous to those of the present year appear to have been made early in the season. The egg, as many of you are aware, is a flat disc about the size of a pin-head, which is cemented fast to the surface of the leaf or fruit, and is so transparent that the green colour shows through and renders it very difficult to see one except when looking for it in the right way. Being cemented to the plant, it will be evident that only the smooth surfaces of the leaf or fruit would be suitable for this purpose. Indeed it was extremely rare to find eggs anywhere except upon a smooth surface. Now, early in the season when the first eggs are being laid, the whole surface of the apples and young leaves is covered with downy hairs. A few of the older leaves soon become smooth on the upper surface, and it is here that the first eggs are laid. These old leaves may be, perhaps, usually are, far away from the fruit, but the most careful search of the surface of the fruit and of the young leaves failed at this time to show any trace of the eggs. Later, but still during the time of the hatching of the winter brood of moths, the under side of the leaf becomes smooth, when eggs may be found beneath the leaves, as well as above them, though never as abundant as on the upper side. Finally the fruit itself also becomes smooth, especially on the upper exposed side. As soon as this is the case the moths show a decided preference for the fruit, and while the eggs are still laid in considerable numbers on the leaves, the number on the fruit is out of all proportion to the amount of surface exposed.

(To be continued.)

DALGETY'S REPORT.

Dalgety and Co., Limited, wool and general brokers, report as follows for the month ending 9th March, 1904:—

Business in farm produce was conducted on extensive lines during February.

Wheat.—Early in February deliveries of wheat were very heavy. However, Western Australian farmers are now showing less inclination to sell. The statistics issued by the Government show that it is estimated that this year's yield of wheat is only 130,000 bushels short of actual estimated requirements. As considerable quantities of Adelaide flour have already been contracted for (being necessary for mixing purposes), it will be seen that, what with our visible wheat supply and the flour contracted for, this State is about supplied with breadstuffs for the current year. This position should, however, be no barrier to Western Australian farmers obtaining prices for their wheat, which are equal to Adelaide values, plus freight, duty, expenses, etc., amounting to 10d. per bushel. It is asserted by local millers, however, that the mills in this State are not capable of gristing the available wheat, and this fact is exercising a depressing influence upon wheat values. It seems to us that the export of at least a small cargo of wheat would have an exceedingly beneficial effect on local values, and a step in this direction should, of course, prove of great benefit to holders of wheat. However, to export wheat just now would certainly necessitate sellers suffering a slight loss on present ruling prices; and as such loss would be benefiting all farmers who are holders of wheat, it is not to be expected that any one or two persons would be likely to undertake to make such a sacrifice. If, however, every large farmer is willing to export a proportion of his wheat, in order to improve the market for the remainder, there is no doubt that this undertaking could be successfully worked. We have for some weeks now been arranging such a cargo on co-operative lines, and are in hopes of being successful. The quality of this year's wheat is very good. Wheat is worth at Perth and Fremantle to-day 3s. 7d. per bushel, which is an improvement of 3d. per bushel upon values which were ruling on the 9th February.

Algerian Oats.—The quality of the local "Algerians" is still much superior to the lines which are being imported from the other States. Supplies are coming forward fairly freely, and demand has been steady, and values remain unaltered. At Perth and Fremantle clean, heavy milling are worth 2s. 4d. per bushel, other qualities at 2s. 3d. Seed: Algerians seem to be difficult to obtain. We have effected sales of prime seed at from 2s. 6d. to 2s. 9d. per bushel.

Chaff came forward in the early part of February steadily, but towards the end of that month and the beginning of March the supplies showed considerable increase; in fact, at the time of this report Perth and Fremantle markets are glutted with chaff from all the leading districts. Of course, it is only to be expected that at this time of the year supplies would come forward very freely, as so many growers are forced to sell for ready money. In a new State like Western Australia such a condition has a detrimental effect on settlement, and we are endeavouring to regulate supplies by assisting weak holders with cash advances. We handled during the month 4,000 tons at auction and privately. Closing rates are as follow:—Prime green wheaten, £3 10s. to £3. 15s. per ton; good quality wheaten, £3 to £3 7s. 6d. per ton; prime oaten, with plenty of colour, £3 17s. 6d. per ton;

inferior samples from £2 per ton upwards. It is to be regretted that such a large proportion of chaff is coming forward in other than prime condition. We have seen chaff which has been cut from splendid samples of hay, absolutely spoiled in the cutting. Farmers either apply too much water when cutting or else they entirely neglect to toughen their hay, and it is a common sight to see in the yards every morning chaff which is either in a badly heated condition or else badly smashed. Really prime green chaff is not plentiful. It is expected that during the present month the position will show no improvement, but towards the end of April values should show some considerable improvement. Of course, it must be remembered that the success or failure of the approaching wet season will exercise a very great influence upon future values.

Hay.—Business in this line has been conducted freely, but at prices which can hardly be called remunerative. We, however; have been selling in small parcels "Wheaten Hay" at £3 15s. per ton f.o.r. Fremantle.

Oaten Hay.—Really prime oaten hay is not very plentiful in Western Australia this year, and first-class samples are in good demand. Sales of really prime "Oaten Hay" have been effected at five (5) guineas per ton on trucks at Northam.

Barley.—Business in local malting has been conducted fairly freely. Liberal sales of prime "Chevalier" having been effected at from 3s. 8d. to 4s. per bushel on trucks. Many samples, however, are badly stained and pinched, selling at from as low as 3s. per bushel.

Local Cape Barley.—None forward during February and March. Nominal value, 3s. per bushel.

Pressed Straw.—We sold good oaten pressed straw at 35s. per ton, Northam; and wheaten straw at 30s. per ton, Northam.

At Kalgoorlie.

Chaff.—The position has been similar to Perth and Fremantle, this market being glutted at the time of this report. Closing prices are as follows:—Prime wheaten, 90s. to 95s. per ton. (These prices are not for primest samples, none having come forward.) Other samples from 80s. per ton upwards.

Wheat.—Limited sales at 4s. per bushel.

Algerian Oats.—This market has large sale for oats, and the difference of price in favour of Algerians as against New Zealands and Tasmanians has forced Algerians into consumption. All oats sent to the goldfields must be crushed. Prices for crushed Algerian feed from 2s. 4d. to 2s. 6d. per bushel on trucks at Fremantle.

New Zealand B Grade Oats, 3s. 1d. per bushel on trucks at Fremantle.

Hides, Skins, etc.

Sheep-skins.—Fair catalogues have been submitted and satisfactory sales made; good conditioned lines meeting a buoyant market. For damaged and inferior lines there was little inquiry

Merino super., 6½d. to 7d. per lb.	Crossbred super., 6½d. to 7d. per lb.
„ medium, 6d. to 6½d. per lb.	„ fine, 6¼d. to 6½d. per lb.
„ inferior, 5¼d. to 5½d. per lb.	„ medium, 5½d. to 6d. per lb.
„ ¼ wool, 5d. to 5⅞d. per lb.	„ coarse, 4¾d. to 5¼d. per lb.
„ Pelts, 4½d. to 5⅛d. per pound	„ pelts, 3¾d. to 4½d. per lb.
„ lamb, 4d. to 4½d. per lb.	Spring lambs, 4¾d. to 5¼d. per lb.

Hides.—Good offerings have been made, light weight being in greatest demand.

Hides.

Prime, stout and heavy, 5½d. to 6d. per lb.
Medium heavy, 4¾d. to 5d. per lb.
Medium light, 4½d. to 4¾d. per lb.
Prime heavy, 5d. to 5½d., per lb.
Extra light, 3½d. to 4d. per lb.

Attention to flaying and preparation for market is most necessary, as all damaged lots rule fully ½d. per lb. below quotations.

Kangaroo, Wallaby, and Euro Skins have elicited keen inquiry, and all forward sold readily at quotations:—

Kangaroo Skins.

Grey fresh, ½lb, 1s. 3d. to 1s. 6d. per lb.
Grey fresh, ¾ to 1½lb., 2s. to 2s. 4d. per lb.
Grey fresh, 2lb., 1s. 7d. to 1s. 9d. per lb.
Red fresh, ½lb., 1s. to 1s. 3d. per lb.
Red fresh, ¾ to 1½lb., 2s. to 2s. 2d. per lb.
Red fresh, 2lb., 1s. 6d. to 1s. 9d. per lb.
Perished lots, 1s. to 1s. 6d. per lb.
Wallaby, 1s. 8d. to 1s. 9d. per lb.
Extra light, to 8½d. per lb.
Euro Skins, 1s. 3d. to 1s. 6d. per lb.

Hair, Horns, and Bones.

Quotations are:—

Horse hair, to 1s. 3d. per lb.
Cows tails, to 6½d. per lb.
Horns, large, to 32s. 6d. per 100
Horns, small, 5s. to 12s. per 100
Rough Bones, 70s. per cwt.

GARDEN NOTES FOR APRIL.

By Percy G. Wicken.

This month will probably see the breaking up of the dry season which we experience in the State during the summer months, and if rain has not already fallen by the time these notes appear, it may be daily expected and consequently the ground should be properly prepared for planting out a good variety of vegetables as early as possible. Experience teaches us that it is the early crops which are most acceptable and which give, as a rule, the most payable results. Those who are anxious to make a success of vegetable growing, will no doubt have the ground already prepared and a large number of

plants raised in seed boxes ready to plant out as soon as the soil gets a good soaking. The land should be thoroughly well manured and dug up before the rain sets in and it is then in a condition to absorb and retain the water when the rain comes. In planting out young seedlings from a seed bed they should not be planted deeper in the ground than they were when growing in the seed bed or box; many plants and also trees are checked in growth by being planted too deeply, care should also be taken that the roots are placed and spread out in the ground in a natural condition; many people seem to think that it is only necessary to punch a hole in the ground and put the plant in, in fact one often sees the young fibrous roots doubled up, and the ends of the roots sticking out of the ground as well as the leaves, this is not natural and it stands to reason that a plant cannot thrive under these conditions. Soon after the first rains a luxurious crop of weeds will no doubt appear and these must be kept cut down so as to allow the vegetables the full use of the soil. A small Planet Junior hand hoe will cut down the weeds over a good sized garden very quickly and without making the back ache by so much stooping down, they are very light, do good work, and cost very very little.

Asparagus.—Prepare a bed, as previously described, when opportunity offers, and have ready to plant out early in the spring.

Beans (Broad).—Sow the main crop as soon as possible. They do best in a clayey soil, but will give good returns on almost any soil. Plant in rows three to four feet apart, and about six inches apart in the rows. Keep planting out a few rows every week, and thereby keep up a continuous supply throughout the winter.

Beet (Silver).—May either be sown in a seed bed or in the open. By sowing in a bed and transplanting, a considerable quantity of seed is saved, and also the trouble of thinning out the rows after the plants come up. The leaves of this plant are used, and the application of a liquid manure will force it along.

Borecole or Kale.—A hardy plant; the curly variety makes a good vegetable. Plant out in drills three feet apart, and use the leaves as required.

Brussels-sprouts.—Are a vegetable well worth growing in the cooler parts of the State. They are improved by a few frosts, and make a welcome addition to the table. Plant and treat the same as cabbages.

Cabbage and Cauliflower.—Have a plentiful supply of young seedlings available to plant out at the first opportunity and plant out as large an area as possible; the plants will be very acceptable for table or for market. Use plenty of good liquid manure to force the growth and make them mature early.

Carrots.—Sow a good supply in drills, the drills should be three feet apart, but two rows of seed may be sown in each drill; if the ground is likely to be wet the seed should be sown on ridges.

Celery.—Sow a little seed and plant out any seedlings you have already raised, this plant requires a rich soil and plenty of water, as the plants acquire a good size they require to be earthed up to cause the stalks to bleach.

Leeks.—Sow a quantity of seed and when plants are about six inches high, plant out in shallow trenches in heavily manured ground.

Onions.—This is a good time to sow, the ground requires to be well manured with well rotted stable manure. Onions prefer a sandy loam well drained. The young plants are delicate and require to be kept free from weeds. The seed may either be sown in beds and planted out or sown direct in the drills; if sown in the drills the plants will require thinning out as soon as they appear. The drills should be about 15 inches apart and the plants four inches apart in the drills.

Parsnips.—A few rows may be sown and treated the same as carrots.

Peas.—Plant as many rows as you have room for. The dwarf varieties two feet apart, and the climbing varieties three feet apart. Manure well with superphosphate and sulphate of potash.

Turnips.—Those already up will require thinning, and a further supply of seed can be sown. Swede turnips should also be sown during the month; the purple top swede makes an excellent vegetable, and is preferred by many to the white and yellow turnips.

Farm.—Where the ground is sufficiently soft to enable the ploughs to do satisfactory work, ploughing should be pushed on with as fast as possible, and as much land as the teams can get over should be prepared for sowing, so that the seed drills can get to work directly the rain falls. The season is short, and if heavy rain comes early in the season the ground soon gets too soft for the horses to work on. All wheat crops should be sown as early as possible. All seed wheat should be pickled before sowing by being immersed for two minutes in a solution of bluestone and water—1lb. of bluestone to five gallons of water. After being dipped the seed should be dried before being put in the seed drill. From three-quarter to one bushel of seed is sufficient to sow per acre if drilled in, and one and a-half bushels if sown broadcast. Owing to the low price of wheat and chaff this season it is not profitable to cart this class of produce over long distances, and it will give much more payable results if fed to pigs and sheep, and marketed in the form of fat stock, for which there is always a good demand.

THE CLIMATE OF WESTERN AUSTRALIA DURING FEBRUARY, 1904.

The climate reports for February afford an excellent illustration of the fact that it is unsafe to trust to the memory of our impressions for weather statistics. There can be little doubt that nearly everybody would write down last month as a remarkably cool one for the time of year, especially in South-Western and Southern districts, but the records show that in all respects it was normal, except that we experienced one very hot day, the hottest recorded at the Observatory during the last seven years, and the nights on the whole were cooler than usual. At the Observatory the mean maximum temperature was 84·6, or only 0·1 below that for previous years, and at Albany it was 73·1, or 1·5 above the average, but the nights in the latter place were exceptionally cool, the mean minimum being 55·9 or 3·7 below that for previous years. The temperature at Coolgardie and Kalgoorlie was slightly below normal.

Pressure conditions were about normal, and the daily weather maps were mostly characterised, as usual, by high pressure over the ocean to the south of the continent, with gradually decreasing isobars, thence to the N.W. coast. There were no severe storms, but the Kimberley district had some heavy rains at times.

The rainfall was above the average in East Kimberley, but elsewhere very light. On the Coolgardie and Murchison fields only a few isolated showers fell.

Once again the weather has been remarkably cool in Adelaide, and therefore our figures compare unfavourably with those of our neighbour, the mean maximum being 3·2 in excess. There was not much rain in Adelaide, but heavy floods were experienced in some of the Northern districts of South Australia. In Melbourne the weather was remarkably cool and wintry. Their mean maximum temperature was 73·7, or 10·9 below ours, and 624 points of rain were recorded, making a total of nearly 12 inches for the first two months of the year. In Sydney also the mean temperature was much lower than ours, but this is the usual characteristic in February, and is counterbalanced by the excessive humidity of the Eastern city.

It should be placed on record that the mail steamers, Orontes and Prinz Regent Luitpold, reported the existence of cyclonic conditions near the Cocos Islands, between the 11th and 13th, but the disturbance was not traceable in this State.

The Climate of Western Australia during February, 1904.

	Locality.	Barometer (corrected and reduced to sea-level).				Shade Temperatures.									Rainfall.	
						February, 1904.					*Average for previous Six Years.					
		Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Points (100 to inch) in Month.	Total Points since Jan. 1.
North-West and North Coast:	Wyndham ...	29·728	29·792	29·879	29·607	95·2	78·3	86·8	101·0	71·8	96·0	79·4	106·0	64·0	708	2015
	Derby	29·740	29·806	29·891	29·614	95·6	77·2	86·4	99·4	69·8	94·7	77·7	104·5	70·0	364	2116
	Broome ...	29·748	29·794	29·893	29·606	93·8	79·6	86·7	100·5	73·0	91·6	78·4	101·5	70·3	123	877
	Condon ...	29·748	29·788	29·937	29·592	95·3	75·9	85·6	103·5	60·6	93·8	77·3	113·0	69·8	15	132
	Cossack ...	29·748	29·776	29·946	29·571	98·9	78·0	88·4	107·0	70·0	97·3	78·5	112·2	61·8	23	250
	Onslow ...	29·735	29·784	29·910	29·590	96·0	74·0	85·0	109·0	65·0	96·5	75·7	115·5	66·0	26	29
	Carnarvon ...	29·827	29·849	29·971	29·667	90·3	70·8	80·6	105·0	63·0	88·5	71·6	111·2	63·8	6	9
	Hamelin Pool...	29·830	29·829	30·000	29·670	97·0	67·0	82·0	105·0	59·0	97·0	69·3	115·4	58·0	*Nil*	*Nil*
	Geraldton ...	29·880	29·904	30·060	29·670	85·4	62·0	73·7	104·5	53·0	84·5	65·9	110·8	51·0	4	4
Inland:	Hall's Creek *	29·781	...	29·959	29·619	95·4	71·3	83·4	102·0	61·6	...	...	...	...	447	1730
	Marble Bar ...	...	...	...	...	104·8	75·8	90·3	112·2	69·0	...	...	...	...	157	266
	Nullagine * ...	29·744	29·766	30·021	29·528	100·9	71·9	86·4	108·0	60·5	99·8	74·9	113·5	66·0	149	312
	Peak Hill ...	29·775	29·848	30·050	29·490	97·0	72·0	84·5	106·0	62·0	96·4	73·6	111·8	58·6	45	52
	Wiluna ...	29·782	...	30·108	29·456	95·4	68·2	81·8	109·3	56·3	...	...	...	...	4	4
	Cue	29·800	29·828	30·110	29·550	97·5	69·6	83·6	109·9	60·3	98·3	71·9	113·8	56·2	*Nil*	*Nil*
	Yalgoo ...	29·826	29·838	30·095	29·568	95·6	66·1	80·8	112·0	59·0	96·7	69·0	116·2	53·9	6	6
	Lawlers ...	29·849	29·852	30·196	29·545	92·9	68·5	80·7	109·1	57·1	93·9	70·5	113·9	51·8	1	10
	Laverton ...	29·883	29·916	30·192	29·565	91·1	64·7	77·9	110·4	53·2	89·8	66·4	108·0	53·7	*Nil*	15
	Menzies ...	29·888	29·882	30·227	29·595	91·2	63·8	77·5	109·0	52·6	92·1	66·8	112·8	47·8	*Nil*	2
	Kanowna ...	...	...	...	...	89·8	60·7	75·2	108·0	48·0	...	...	...	...	*Nil*	*Nil*
	Kalgoorlie ...	29·919	29·934	30·253	29·576	89·0	61·1	75·0	106·8	49·0	90·2	63·7	115·0	48·2	*Nil*	4
	Coolgardie ...	29·924	29·908	30·263	29·603	88·6	60·1	74·4	107·5	48·2	90·6	62·7	114·3	47·4	*Nil*	1
	Southern Cross	29·902	29·892	30·224	29·564	92·5	59·4	76·0	110·0	48·0	92·2	62·4	112·0	46·6	*Nil*	14
	Walebing ...	...	...	...	...	90·5	59·5	75·0	110·0	46·0	...	...	...	...	4	4
	Northam ...	...	...	...	...	91·1	60·0	75·6	110·0	50·0	...	...	...	...	*Nil*	*Nil*
	York	29·936	29·936	30·232	29·571	90·2	57·7	74·0	110·2	48·0	90·4	62·8	115·6	45·8	1	2
	Guildford ...	...	...	...	...	89·6	59·4	74·5	112·0	51·0	...	...	...	...	14	23

* For he first time means of previous years are taken between 1897 (when the Meteorological Service was re-organised) and 1902 (inclusive). All observations prior to 1897 have been rejected, except in the case of the Perth Botanical Gardens.

The Climate of Western Australia during February, 1904—*continued.*

Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Shade Temperatures. February, 1904. Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	*Average for previous Six Years. Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Total Points since Jan. 1
South-West and South Coast:															
Perth Gardens ...	29·958	29·916	30·220	29·634	87·7	61·7	74·7	106·0	53·4	88·7	63·0	113·8	49·0	11	26
Perth Observatory	29·966	29·956	30·234	29·634	84·6	61·6	73·1	106·7	53·3	84·7	63·4	106·8	47·7	12	23
Fremantle ...	29·975	29·944	30·227	29·652	81·0	62·2	71·6	102·5	54·5	82·6	64·1	106·0	48·5	8	23
Rottnest ...	29·969	29·904	30·221	29·646	79·3	63·7	71·5	105·0	56·0	81·3	63·6	102·6	52·0	10	12
Mandurah ...	...	...	...	...	82·9	58·4	70·6	...	49·0	...	...	...	...	13	19
Wandering ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Collie	...	...	...	...	85·2	49·7	67·4	101·0	40·4	...	...	...	...	10	34
Donnybrook ...	...	...	...	...	83·9	54·1	69·0	99·9	43·4	...	...	...	...	26	64
Bunbury ...	29·980	29·978	30·220	29·780	80·8	56·5	68·6	97·0	45·0	81·6	58·9	101·5	42·0	32	65
Busselton ...	...	...	...	...	80·1	52·6	66·4	91·0	42·0	...	...	...	...	23	34
Bridgetown ...	...	...	...	...	84·2	46·5	65·4	102·0	36·0	...	...	...	...	4	37
Karridale ...	29·950	30·003	30·220	29·600	77·0	53·0	65·0	90·0	46·0	76·8	57·1	105·5	41·1	36	94
Cape Leeuwin ...	29·990	29·970	30·250	29·530	74·0	62·0	68·0	79·0	57·0	73·5	62·6	103·8	54·8	23	129
Katanning ...	29·965	29·963	30·290	29·580	83·4	52·0	67·7	100·0	43·0	84·7	55·1	109·0	37·9	15	15
Albany	30·030	30·045	30·320	29·642	73·1	55·9	64·5	83·2	48·4	71·6	59·6	100·3	41·1	29	115
Breaksea... ...	...	30·002	30·340	29·510	70·0	60·0	65·0	77·0	...	70·2	60·5	81·5	50·0	58	107
Esperance ...	29·997	30·022	30·338	29·686	78·0	61·0	69·5	99·0	41·0	77·6	60·2	113·0	42·2	23	45
Balladonia ...	29·992	...	30·320	29·631	84·8	53·7	69·2	111·2	43·0	...	...	...	...	*Nil*	*Nil*
Eyre*	29·944	29·997	...	...	77·9	59·0	68·4	116·0	38·0	78·8	61·5	110·0	42·0	15	63
INTER-STATE.															
Perth	29·966	29·956	30·234	29·634	84·6	61·6	73·1	106·7	53·3	84·7	63·4	106·8	47·7	12	23
Adelaide	29·890	29·979	30·300	29·550	81·4	61·5	71·4	104·0	52·0	86·2	62·0	113·6	47·4	27	280
Melbourne	29·862	29·886	30·289	29·502	73·7	56·8	65·2	96·7	49·0	77·8	56·6	109·0	40·3	624	1192
Sydney	29·890	29·977	30·230	29·390	76·0	63·0	69·5	84·0	53·0	77·1	64·8	101·0	47·3	395	588

* For the first time means of previous years are taken between 1897 (when the Meteorological Service was re-organised) and 1902 (inclusive). All observations prior to 1897 have been rejected, except in the case of the Perth Botanical Gardens.

The Observatory, Perth,
March, 1904.

W. E. COOKE,
Government Astronomer.

RAINFALL for January, 1904 (completed as far as possible), and for February, 1904 (principally from Telegraphic Reports).

Stations.	January.		February.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
East Kimberley:				
Wyndham ...	1307	25	708	11
6-Mile	1497	18	1042	9
The Stud Station	...	...	...	...
Carlton	1611	18	417	6
Denham	...	...	...	...
Rosewood Downs	...	...	...	...
Argyle Downs ...	...	...	...	...
Lisadell	...	...	...	...
Turkey Creek ...	719	...	692	9
Plympton, St. Mary	...	...	...	...
Hall's Creek ...	1283	...	447	...
Flora Valley ...	...	...	...	...
Denison Downs...	1528	...	...	...
West Kimberley:				
Obagama ...	...	...	...	...
Beagle Bay ...	...	...	...	...
Derby	1752	11	364	7
Yeeda	781	9	...	...
Liveringa ...	759	11	...	...
Mt. Anderson ...	...	...	...	...
Leopold Downs...	1175	15	...	...
Fitzroy Crossing	1150	10	186	7
Fitzroy (C. Blythe)	921	10	...	...
Quanbun ...	1175	7	...	...
Nookanbah ...	1569	12	...	...
Broome	754	13	123	6
Roebuck Downs	532	7	...	...
Thangoo	...	...	...	...
La Grange Bay...	522	9	104	6
North-West:				
Wallal	138	6	36	3
Condon	117	6	15	2
Pardoo	190	5	...	...
DeGrey River ...	34	3	...	...
Port Hedland ...	59	5	...	...
Boodarie ...	202	4	...	...
Warralong ...	139	7	...	...
Muccan	177	5	...	...
Ettrick	203	6	...	...
Mulgie	328	5	...	...
Eel Creek ...	165	5	...	...
Pilbarra	...	...	...	...
Coongon	79	6	...	...

Stations.	January.		February.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
North-West—*cont.*				
Warrawagine ...	86	2	...	...
Bamboo Creek ...	67	7	230	8
Marble Bar ...	109	6	157	6
Warrawoona ...	54	2	325	3
Corunna Downs...	...	...	...	...
Nullagine ...	163	4	149	5
Mount Edgar ...	152	6	...	...
Kerdiadary ...	Nil	...	...	...
Roy Hill	...	...	...	...
Middle Creek ...	...	...	...	...
Mosquito Creek	180	3	...	...
Mulga Downs ...	Nil	...	...	...
Woodstock ...	132	4	...	...
Mt. Florence ...	127	5	...	...
Tambrey ...	72	2	...	...
Millstream ...	20	1	...	...
Yandyarra ...	...	...	...	...
Mallina	...	...	...	...
Whim Creek ...	205	3	24	2
Cooyapooya ...	...	...	...	...
Woodbrooke ...	154	4	...	...
Croydon	152	3	...	...
Roebourne ...	80	3	38	3
Cossack	227	3	23	1
Fortescue ...	6	2	Nil	...
Mardie	7	2	...	...
Mt. Stewart ...	...	...	...	...
Yarraloola ...	...	...	...	...
Chinginarra ...	31	2	...	...
Onslow	3	1	26	2
Peedamullah ...	246	7	...	...
Red Hill	73	1	...	...
Mt. Mortimer ...	Nil	...	...	...
Peake Station ...	36	4	...	...
Nanutarra ...	27	3	...	...
Yanrey	120	4	...	...
Point Cloates ...	33	1	...	...
Gascoyne:				
Winning Pool ...	89	3	Nil	...
Coodalia ...	52	3	...	...
Towara	49	4	...	...
Ullawarra ...	...	...	...	...
Maroonah ...	...	...	...	...
Gifford Creek ...	Nil	...	...	...
Bangemall ...	Nil	...	...	...

RAINFALL—*continued.*

Stations.	January. No. of points. 100 = 1in.	January. No. of wet days.	February. No. of points. 100 = 1in.	February. No. of wet days.
GASCOYNE—*contd.*				
Minnie Creek ...	18	1	..	...
Yanyeareddy ...	45	3	...	...
Wandagee ..	54	3	...	...
Bernier Island ...	Nil	...	...	...
Boolathana ...	Nil	...	...	...
Carnarvon ...	3	1	6	1
Brick House ...	7	1	Nil	...
Doorawarrah ...	1	1	...	...
Mungarra ...	Nil	...	...	...
Dairy Creek ...	Nil	...	...	...
Upper Clifton Downs	Nil	...	...	...
Dirk Hartog Is'nd	Nil	...	...	...
Sharks Bay ...	Nil	...	Nil	...
Meedo	42	1	...	...
Wooramel ...	Nil	...	Nil	...
Hamelin Pool ...	Nil	...	Nil	...
Byro	...	...	...	...
Yarra Yarra ...	...	...	...	...
Berringarra ...	...	...	...	...
Mt. Gould ...	...	...	...	...
Moorarie ...	Nil	...	...	...
Wandary... ...	Nil	...	...	...
Peak Hill ...	7	1	45	2
Horseshoe ...	6	1	25	3
Abbotts	4	1	Nil	...
Belele	...	...	...	...
Mileura	10	1	...	...
Milly Milly ...	...	...	...	...
Manfred ...	3	1	...	...
Woogorong ...	Nil	...	...	...
Boolardy... ...	...	...	...	...
Twin Peaks ...	Nil	...	...	...
Billabalong ...	Nil	...	...	...
Wooleane ...	40	1	...	...
Meka	17	1	...	...
Mt. Wittenoom ...	Nil	...	...	...
Nannine	Nil	...	5	1
Star of the East...	Nil	...	7	1
Annean	8	2	Nil	...
Coodardy ...	..	...	...	...
Cue	Nil	...	Nil	...
Day Dawn ...	3	1	9	1
Lake Austin ...	Nil	...	Nil	...
Lennonville ...	31	2	1	1
Mt. Magnet ...	1	1	Nil	...
Challa	Nil	...	Nil	...
Murrum	Nil	...	...	...

Stations.	January. No. of points. 100 = 1in.	January. No. of wet days.	February. No. of points. 100 = 1in.	February. No. of wet days.
GASCOYNE—*contd.*				
Burnerbinmah ...	Nil	...	...	...
Barnong... ...	Nil	...	...	...
Mellinbye ...	Nil	...	6	1
Yalgoo	Nil	...	6	1
Wagga Wagga ...	Nil	...	15	1
Gabyon	Nil	...	Nil	...
Wurarga ...	...	...	...	...
Gullewa	Nil	...	Nil	...
SOUTH-WEST DIVISION (NORTHERN PART):				
Murchison House	Nil	...	...	...
Mount View ...	Nil	...	...	...
Mumby	Nil	...	3	1
Yuin	...	...	...	...
Northampton ...	Nil	...	5	1
Oakabella ...	...	...	...	...
Narra Tarra ...	Nil	...	...	...
Tibradden ...	...	...	...	...
Sand Springs ...	Nil	...	Nil	...
Mullewa... ...	Nil	...	1	1
Kockatea ...	...	...	...	...
Bootenal ...	...	...	...	...
Geraldton ...	Nil	...	4	2
Greenough ...	Nil	...	Nil	...
Dongara ...	Nil	...	2	1
Dongara (Pearse)	...	...	...	...
Mingenew ...	Nil	...	3	2
Urella	Nil	...	...	...
Yandenooka ...	...	...	...	...
Rothesay ...	...	...	...	...
Field's Find ...	Nil	...	Nil	...
Carnamah ...	Nil	...	1	1
Watheroo ...	Nil	...	Nil	...
Dandaragan ...	Nil	...	Nil	...
Moora	Nil	...	1	1
Yatheroo ...	Nil	...	...	...
Walebing ...	Nil	...	4	1
New Norcia ...	Nil	...	5	1
SOUTH-WESTERN DIVISION, CENTRAL (COASTAL):				
Gingin	Nil	...	8	2
Belvoir	1	1	15	1
Mundaring ...	6	1	30	2
Guildford ...	9	2	14	2

RAINFALL—*continued.*

Stations.	January. No. of points. 100 = 1in.	January. No. of wet days.	February. No. of points. 100 = 1in.	February. No. of wet days.
SOUTH-WESTERN—*continued.*				
Kalbyamba ...	3	1	15	2
Canning W't'r'w'ks	8	1	5	1
Perth Gardens ...	15	3	11	2
Perth Observatory	11	3	12	2
Subiaco	10	2	13	2
Fremantle ...	15	2	8	2
Rottnest	2	2	10	1
Armadale ...	17	2	...	...
Rockingham ...	15	2	20	1
Canning River ...	...	...	...	...
Jarrahdale ...	25	1	51	2
Mandurah ...	6	1	13	1
Pinjarra	24	2	17	1
Yarloop	30	3	...	...
Harvey	23	2	36	2
SOUTH-WEST, CENTRAL PART (INLAND):				
Dowerin ...	Nil	...	Nil	...
Momberkine ...	Nil	...	2	1
Monglin ...	Nil	...	Nil	...
Newcastle ...	Nil	...	Nil	...
Eumalga ...	Nil	...	Nil	...
Northam ...	Nil	...	Nil	...
Grass Valley ...	Nil	...	Nil	...
Meckering ...	Nil	...	Nil	...
Cunderdin ...	Nil	...	Nil	...
Codg-Codgin ...	2	1	Nil	...
Yarragin ...	4	2	Nil	...
Doongin	Nil	...	Nil	...
Cuttening ...	Nil	...	Nil	...
Whitehaven ...	Nil	...	...	...
Sunset Hills ...	Nil	...	Nil	...
Cobham	Nil	...	5	1
Yenelin	Nil	...	Nil	...
York	1	1	1	1
Beverley ...	Nil	...	Nil	...
Bally Bally ...	1	1	...	...
Barrington ...	Nil	...	Nil	...
Stock Hill ...	Nil	...	Nil	...
Wandering ...	15	2	...	...
Glen Ern ...	3	1	5	2
Pingelly ...	Nil	...	Nil	...
Marradong ...	4	1	6	1
Bannister ...	4	2	6	2
Narrogin ...	Nil	...	5	2
Wickepin ...	...	...	...	...

Stations.	January. No. of points. 100 = 1in.	January. No. of wet days.	February. No. of points. 100 = 1in.	February. No. of wet days.
SOUTH-WEST—*contd.*				
Gillimaning ...	Nil	...	...	...
Bunking ...	Nil	...	Nil	...
Bullock Hills ...	Nil	...	...	...
SOUTH-WEST DIVISION (SOUTHERN PART):				
Bunbury ...	33	3	32	2
Collie	24	3	10	2
Glen Mervyn ...	42	3	...	...
Dardanup ...	22	1	...	...
Donnybrook ...	38	2	26	1
Boyanup ...	18	2	...	...
Busselton ...	11	2	23	1
Quindalup ...	30	1	...	...
Cape Naturaliste	31	5	10	2
Lower Blackwood	30	1	10	1
Karridale ...	58	4	36	6
Cape Leeuwin ...	106	9	23	9
Biddellia ...	67	6	11	4
The Warren ...	86	6	41	3
Lake Muir ...	33	5	16	2
The Peninsula ...	23	4	...	...
Mordalup ...	10	2	...	...
Deeside	24	5	7	1
Riverside ...	27	4	10	2
Balbarup ...	26	2	...	...
Wilgarup ...	49	4	...	...
Mandalup ...	...	...	...	...
Bridgetown ...	33	4	4	1
Westbourne ...	9	3	15	2
Hilton	...	...	...	...
Greenbushes ...	83	2	15	1
Greenfields ...	19	2	11	1
Glenorchy ...	15	2	...	...
Williams ...	2	1	Nil	...
Arthur	1	1	Nil	...
Darkan	Nil	...	...	...
Wagin	2	1	12	3
Glencove ...	1	1	8	2
Dyliabing ...	Nil	...	11	3
Katanning ...	Nil	...	15	...
Kojonup ...	3	1	12	1
Broomehill ...	9	3	10	2
Sunnyside ...	...	...	3	1
Woodyarrup ...	Nil	...	10	2
Meanelup ...	...	...	...	...
Cranbrook ...	4	1	...	...
Blackwattle ...	...	...	...	...

RAINFALL—*continued*.

Stations.	January. No. of points. 100 = 1in.	January. No. of wet days.	February. No. of points. 100 = 1in.	February. No. of wet days.
SOUTH-WEST—*contd.*				
Woogenellup ...	10	3	12	3
Mt. Barker ...	30	4	14	3
Kendenup ...	16	3	Nil	...
St. Werburgh's...	36	5	10	1
Forest Hill ...	59	7	...	...
Denmark ...	99	5	69	6
Grassmere ...	110	6	39	7
Albany	91	5	24	7
King River ...	55	4	24	5
Point King ...	102	4	12	4
Breaksea ...	49	8	58	9
Wattle Hill ...	100	5	...	...
Cape Riche ...	13	2	...	...
Bremer Bay ...	6	2	24	5
Jarramongup ...	8	2	...	...
EASTERN DIVISION:				
Dural	20	2	...	...
Lake Way ...	Nil	...	4	2
Gum Creek ...	Nil	...	...	...
Mt. Sir Samuel ...	Nil	...	37	1
Lawlers	9	3	1	1
Leinster G.M. ...	21	1	8	1
Lake Darlôt ...	...	...	...	...
Mt. Leonora ...	Nil	...	8	1
Mt. Malcolm ...	3	1	Nil	...
Mt. Morgans ...	Nil	...	Nil	...
Burtville ...	...	...	...	...
Laverton ...	15	2	Nil	...
Murrin Murrin...	18	2	26	1
The Granites ...	15	2	Nil	...
Tampa	2	1	...	...
Kookynie ...	37	2	Nil	...
Niagara	7	2	Nil	...
Yerilla	13	1	Nil	...
Edjudina ...	Nil	...	...	...
Menzies	2	1	Nil	...
Mulline	6	1	Nil	...
Waverley ...	1	1	Nil	...
Goongarrie ...	4	1	Nil	...
Mulwarrie ...	Nil	...	2	1
Bardoc	Nil	...	Nil	...
Kurawa	Nil	...	Nil	...
Kurnalpi ...	Nil	...	Nil	...
Bulong	Nil	...	Nil	...
Kanowna ...	Nil	...	Nil	...
Kalgoorlie ...	4	1	Nil	...

Stations.	January. No. of points. 100 = 1in.	January. No. of wet days.	February. No. of points. 100 = 1in.	February. No. of wet days.
EASTERN—*contd.*				
Coolgardie ...	1	1	Nil	...
Burbanks ...	14	4	Nil	...
Woolubar ...	Nil	...	Nil	...
Widgiemooltha...	Nil	...	Nil	...
50-Mile Tank ...	Nil	...	Nil	...
Waterdale ...	38	2	Nil	...
Norseman ...	Nil	...	Nil	...
Lake View ...	8	1	Nil	...
Bulla Bulling ...	26	1	Nil	...
Woolgangie ...	Nil	...	...	...
Boondie	Nil	...	Nil	...
Boorabbin ...	Nil	...	Nil	...
Koorarawalyee...	13	1	Nil	...
Karalee	Nil	...	Nil	...
Yellowdine ...	Nil	...	Nil	...
Southern Cross...	14	2	Nil	...
Parker's Range...	10	2	...	...
Parker's Road ...	...	...	...	...
Mt. Jackson ...	Nil	...	...	...
Bodallin ...	Nil	...	...	...
Burracoppin ...	...	...	...	...
Kellerberrin ...	Nil	...	Nil	...
Merredin ...	Nil	...	Nil	...
Mangowine ...	...	...	...	...
EUCLA DIVISION:				
Ravensthorpe ...	10	2	8	2
Coconarup ...	13	3	20	3
Hopetoun ...	15	4	26	4
Fanny's Cove ...	20	1	Nil	...
Park Farm ...	2	1	9	4
Esperance ...	22	5	23	6
Gibson's Soak ...	28	4	18	4
30-Mile Condenser	21	3	...	...
Swan Lagoon ...	7	2	...	...
Grass Patch ...	6	3	10	2
Myrup	17	4	20	5
Lynburn ...	12	1	19	2
Boyatup... ...	...	...	...	...
Point Malcolm ...	9	3	20	2
Israelite Bay ...	7	4	18	4
Balbinia... ...	1	1	...	...
Frazer Range ...	Nil	...	...	
Balladonia ...	Nil	...	Nil	...
Southern Hills ...	Nil	...	...	...
Eyre	48	2	15	4
Eucla	3	1	98	5

The Observatory, Perth,
9th March, 1904.

W. E. COOKE,
Government Astronomer.

By Authority: WM. ALFRED WATSON, Government Printer, Perth.

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NOTES.

PLANTING SEASON.—To those of our readers who intend to lay down fresh orchards or add to those they already have, we strongly advise them to obtain Mr. Despeissis' "Handbook on Horticulture and Viticulture," as a perusal of its pages will save much trouble, and in many instances useless expenditure of money.

FRUIT FLY PARASITE.—We take the following from a New South Wales exchange:—"The reported breeding of a parasite wasp, by Mr. Luke Gallard, of Kenthurst, which, it is alleged, will prey upon the fruit fly, is being keenly discussed amongst orchardists. The fly has caused enormous destruction to stone fruits this season, and growers would gladly welcome the discovery of effective means of eradicating the pest."

A NEW SUGAR PLANT.—A plant which yields twenty times as much sugar as the beet or cane has been analysed at the Agricultural Institute of Paraguay. The sugar can be used for all culinary purposes, and its small bulk and weight commend it as a part of the soldier's ration. The plant is a shrub less than a foot in height, and is known to botanists as *Eupatorium repandum*, and belongs to the same natural order as the roughwort or boneset.

INSECT PESTS.—In last December's number of the *Journal*, a letter from Mr. C. W. Woodworth, entomologist of Berkeley, California, was published, as also a reply by Mr. Compere, Government Entomologist of this State. The question at issue was the

advantage of parasites over that of spraying and fumigating for the destruction of insect pests. Mr. Woodworth has now written a reply to the comments on his former letter, which reply is published in this issue of the *Journal*.

PROSECUTION UNDER THE INSECT PESTS ACT.—On Monday, 14th March last, R. J. Green was proceeded against for a breach of the Insect Pests Act, inasmuch as he did neglect to carry out the instructions of an Inspector appointed under the Act. The said instructions consisted of the manner in which certain trees were to be treated for San José scale. The case was heard before Dr. Lovegrove. The defendant, who pleaded guilty, and stated he did not really mean to ignore the instructions, was mulcted in a nominal fine.

A NEW WHEAT.—Among the new wheats that have been tried by Mr. Berthoud one of the best is known as "No. 67." It is very early, had fine large heads, large plump grain, and does not shed freely. It has now been sufficiently long grown to see that it grows true to type, and can be placed on the market with confidence. As it is now beyond the experimental stage, and this coming season there will probably be a considerable quantity sown, it has been decided to call it "Alpha," by which name it will be known in the future instead of "67."

FUMIGATING FOR SAN JOSE.—In the Notes appearing in the last issue of the *Journal*—under the heading of "Orchard Inspection"—the following paragraph appears:—"It was demonstrated that, as the eggs of the scale kept alive even after being fumigated, to successfully cope with these pests spraying was by far the best means available." This referred to mussel scale only, and not, as it appears to be, to San José scale as well. This correction is made in order to further emphasize the importance of fumigating for the San José scale, as the best known means available to overcome this pest, and also to correct any misapprehension that might arise from the wording of the paragraph referred to.

FOWL TICK.—From a recent report of Mr. Robertson's, the poultry expert, we glean the pleasing fact that, after a careful inspection of districts on the Great Southern line, the majority of places were found free from the fowl tick pest. Amongst those towns named are Pingelly, Brookton, Albany, Woodanilling, Broome Hill, and Narrogin. Mr. Robertson, in referring to Albany, says:—"I made a very careful inspection of Albany, lasting over two days, and visited all places in the town itself, and for a few miles round, where I thought tick might be found; I also made exhaustive inquiries, but could not find any traces of the pest. I consider this district a particularly good one for poultry raising."

Mt. Erin Estate.—This fine estate—recently purchased by the Government and thrown open for selection—has attracted considerable attention amongst intending settlers. Already some seven thousand acres have been applied for out of the twenty thousand acres which comprise the estate. There is a great many selections still available suitable for cereals, orchards, or vineyards. The Government experimental farm at the Chapman, which is close to the Mt. Erin estate, has given a practical illustration of the capabilities of the soil, the yield for this season being from first-class land, 25 bushels to the acre, and from third class land, 20 bushels. These returns are from the first crops on virgin soil, which had been manured with 100cwt. of super to the acre. As the bulk of the Mt. Erin estate contains far better soil than that of the Chapman farm, the balance of the ground should soon be taken up.

Fowl Tick.—The poultry expert, Mr. F. Robertson, made a visit recently to Bunbury, at the request of certain residents, in order to give advice on the treatment and eradication of fowl tick existing there. In his report, Mr. Robinson states:—"I made a careful inspection of a large number of places, but only four or five yards were found to be badly infested. The owners of these places promptly acted on my advice, and burnt all fowl houses and adjoining fences. Only one other place situated in the town was found to be infested, but very slightly. The pest had been taken there by fowls purchased from one of the infested yards. The birds were at once returned, and measures taken to eradicate the insects on the place. I am strongly inclined to think that the tick is confined to a very small area; and as the owners are dealing with the matter in an energetic manner, it is to be hoped that the district will soon be clean."

Stingless Bees.—A consignment, as original as interesting, has just been made from Brazil (South America) to the Vienna School of Apiculture. It consists of a colony of stingless bees of the species *Melipona Anthidioides Lep.* These bees are intrepid travellers, for, sheltered in an old case, they have successfully endured the long sea voyage across the Atlantic, as well as the trip of six days between England and Vienna. This consignment was despatched by the Consul-General for Austria at Bombeira, Rio de Janeiro. While *en route* the "Melipones" used to receive every second day a ration of thin sugar syrup, and from time to time a little flour was also offered them, to replace the natural pollen of which the force of circumstances had deprived them.—*Revue Eclectique.* [While we would gladly welcome a family of stingless bees, we cannot but think that something must be sacrificed to make up for this advantage, either a lack of honey gathered or some other drawback. We will wait, however, until we hear more of them.—Ed. Journal.]

PORT WINE.

By A. Despeissis.

Portugal is probably better known abroad by its Upper Douro wines, called all the world over "Port wine," than by any other of its productions.

That name, that wine owes to Oporto (the Port), the centre of its distribution, more than to the locality which produces it. As a matter of fact, its home lies some distance from that flourishing town over that peculiarly gifted country, the Traz os Montes and Beira Alta, through which runs the Upper Douro and some of its affluents.

The evolution of port wine is such an interesting one, its presence is now so general on the dining-table of a large section of the well-to-do classes in England, as well as in every British possession, that with the object of learning something more definite regarding the surroundings in which it is grown, and the circumstances which attend its manufacture, I paid a visit last vintage time to the cradle of that famous dessert wine.

Entering Portugal from the Spanish side, after having travelled from the rich alluvial plains of Seville on the Guadalquiver, over the apparently barren slopes of the Sierra Morena, the train reaches the Guadiana river, which in parts of its course constitutes the south-east boundary between Spain and Portugal. Here at Mérida, once the capital of the Roman province of Lusitania, and called the "Spanish Rome," one line of railway leads towards Badajoz, the border town, and Lisbon.

In Spain, however, short cuts are often the longest, and travellers are ill-advised to diverge from trunk lines. For that reason, I went as far as Cáceres, in Lower Estremadura, where rocky slopes carrying here and there clumps of the cork oak and of the evergreen oak (*bellotas*) give place to more fertile undulations under vines, olives, figs, and almonds.

The Madrid to Lisbon line follows the valley of the Tagus, which springs in the mountains of New Castile and runs almost due west.

Like Spain, Portugal presents within the narrow space the sight can span from the crest of a Sierra, a great variety of natural features. It also follows that in harmony with the outlines of the country, soils and climates vary in a striking manner even within a short distance.

These sudden changes are punctuated by the vegetation which at times is characteristic of the heaths of the high wintry plateaus and slopes of northern Europe and Scotland, whilst lower down in

the deep valleys the prickly pear, the agave, and the bamboo would lead one to imagine that it is a bit of Algeria that lies there within sight. Between the two extremes rich meadows unfold themselves, and the olive, the orange, the fig, the vine, and the carob bean thrive with great luxuriance, while small fields of corn, maize, beans, lucerne are dotted here and there wherever the physical accidents of the county permit.

After a lengthy railway journey down the wide valley of the Tagus, and amongst the hill district of Portuguese Estremadura, and change at Entrocamento, the train heads northwards, and fringes the coast line between the rugged sea coast and the numerous spurs of the Serra da Estrella. Pine woods, vineyards, and cornfields alternate with woods of cork oak.

At last Villa Nova de Gaia is reached: on the left bank of the Douro and Oporto is seen seated on the steep slopes on the right bank opposite. It is here the headquarters of the port wine magnates, who own numerous "lodges" where the celebrated wine is stored, matured, and prepared for shipment.

From Villa Nova de Gaia the train proceeds to Oporto, crossing the deep rocky ravine of the Douro on a splendid iron bridge, constructed by Messrs Eiffel and Co., whose name is intimately associated with the famous tower on the Champ de Mars, which is a prominent land mark of modern Paris. This bridge, my notes tell me, is over 17 chains long; it carries two roadways, one 33 feet above the river, and the other 200 feet high. It crosses the gorge in a single span of 560 feet, and it trembles when a heavy load is drawn over it. As customary in many other places in Spain and in Portugal, a toll has to be paid at the barrier when entering the bridge, at each end of which gather knots of the omnipresent beggars who find at this wind-swept elevation a strategic position of no mean profit.

Of Oporto itself and its picturesque environs much could be said; but as the main object of these notes is to impart some little information about "Port wine" and the country that produces it, I must curtail them and abruptly enter into the subject.

Soon after arriving in Oporto, a stroll took me to Villa Nova de Gaia, for the purpose of presenting my credentials to the firm I was directed to. My call was expected, as our mutual London friend had also advised them of my intended visit.

Portugal, as a whole, does no more produce one type of wine than does Australia, and as climate, soil, varieties of grapes, and methods of training vary, so do the class of wine produced.

Between the two extremes, viz., the light, tart wines of Minho and the heavy, liquorous wines of the Douro, there is a whole host of wines which vary in colour, in strength, and in taste. Thus, the *Torres-Vedras*, the *Santarem*, and the *Lavradio*, which somewhat resemble the Hermitage wine, and are produced in the neighbourhood of Lisbon; the white wines of *Setubal* in

Estramadura, one dry, spirituous, and perfumed like a sherry; the other a muscat, rich in sugar, in spirit, in body, and in aroma.

The *Carcavellos*, white, generous wines, which rank next to Port and Madeira.

The *Collares*, near Lisbon, of which there are both red and white. These wines are light, tart, and may be compared to an inferior Bordeaux.

There are others, but they have even less claim to distinction. Many of these wines known under the name of *consumos* are cheap, natural wines which are daily used as table wines or are shipped to Brazil, which does an important trade with the parent country.

Although dry and unfortified, several possess a port wine flavour, and in that respect are unlike the wines of France. The cheaper wines still, the "green wines" in particular, which are made from grapes trained on trees in Northern districts of Portugal and notably in the Province of Minho, are either drunk by the poorer classes or distilled for providing some of the brandy required in the manufacture of port wine. These vines are also known as *vinhos de enforcado*, being hung from the mother plants as is sometimes seen in many parts of the Peninsula as well also as in Italy.

Historical Notes.

The climate of Portugal is essentially a maritime one, and is moister than that of Spain. For that reason the wine is generally lighter, and in olden days, before fortification commenced to be made use of in wine-making, its keeping qualities were inferior to those of Spanish wines. Interchange and commerce, on account of the rough nature of the country, was also slower, and Portuguese wines for a long time were little or not known abroad.

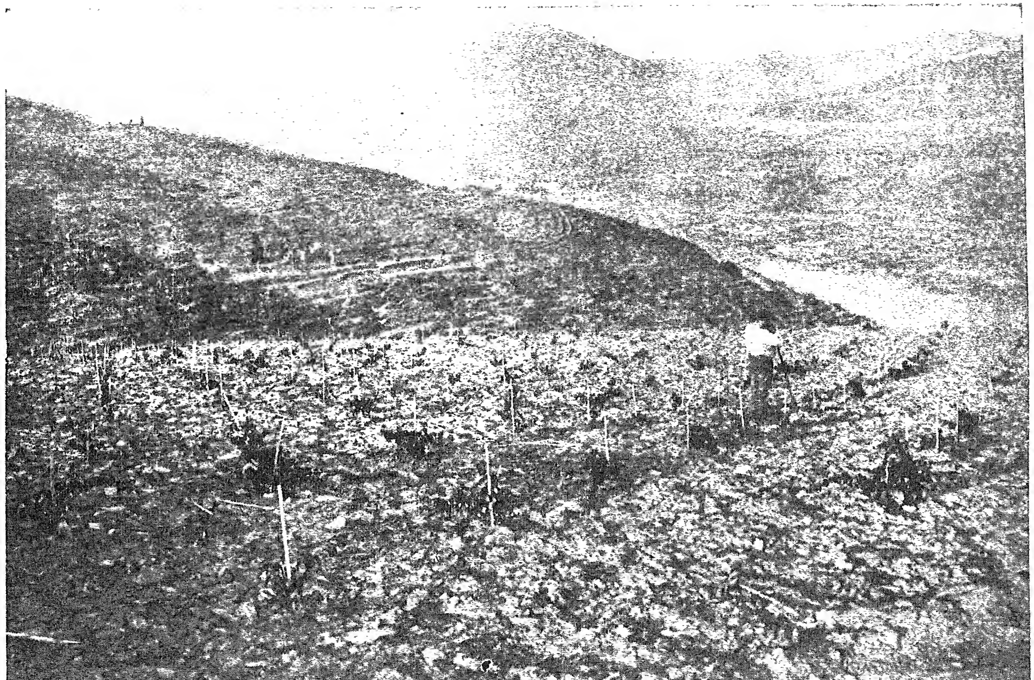
Being of less strength than the wines of Spain, the Portuguese wines, in course of time, received an addition of alcohol to enable them to keep and bear a sea voyage.

From that time it commenced to take a hold of foreign markets, and the *vinos de fectoria*, or factory wines, were bought by English trading houses and shipped to England, and gradually to Scandinavia and other cold climate countries where the warmer wines find favour.

With new outlets for the wine, greater expansion was given to the vineyards.

I was also told that it was after a complete failure of the vintage in Italy that English traders first came and sought the dark and spirituous wines.

It was, however, only 200 years ago, as a result of the Methuen treaty, whereby, in consideration of a free importation into Portugal of British woollen goods, the wines of Portugal were allowed to enter England on paying two-thirds of the existing duty, that a real impulse was given to the port wine trade.



Upper Douro Valley, with the river running between vine-clad hills cut into terraces. "Lagars," or fermenting houses, are seen scattered among the vineyards.

The customs records at Oporto only report, in 1678, the shipping of the first pipe of port. During the 10 years following this event 600 pipes were shipped each year; and at the time of the Methuen treaty the exportation had reached 11,000 pipes, and gradually increased to 16,000 pipes.

At that period a check was given to the expanding trade by the greed of the exporters, who, unable to supply themselves with the choicer Upper Douro wines, foolishly, it is said, tampered with them, and by large admixtures of "green wines" from the Minho other localities around.

They increased their stock, correcting the tartness of the fresh additions by means of sugar, adding to its colour by admixtures of Elderberry wine, and giving a bite to the whole concoction by the use of pepper and other ingredients.

As a consequence of these practices the price of the Douro wine fell even below that of ordinary but unadulterated wine.

To drag the once flourishing trade out of the mire it had sunk into, Pombal, the "Gran Marquez," and at the time the all-powerful minister at the court of Portugal, organised a wine company of the Upper Douro, to whom was granted a monopoly.

Every Easter, after the newly-made wine had, during the previous winter, purged part of its impurities, a wine fair was held at the prettily situated town of Regoa, at the junction of the Douro with its affluent the Corgo, in the centre of the *Paiz do Vinho.* There a tribunal of four tasters, two of whom represented the company and two the growers interests, sampled and classified the wine of the district and appraised its market value at the "lagar" or fermenting house. The company then purchased these wines of which the first class wine alone was eligible for exportation, the second class article being retailed by the company's agents in the wine shops of Oporto and of the country around.

This monopoly of the retail trade was, at first, openly resisted by the citizens. Many of them during the conflict lost their life, and blood ran on the pavement of Oporto.

The company carried on their policy in high handed style. Transportation for life threatened the wine manipulator, the possession of an Elder tree on a farm within the privileged wine district was made a felony.

That law was more or less vigorously enforced for seventy years or so, and only fell with the old company which had then become objectionable through abuse and extortion.

When all restrictions were removed the Elder tree became once more an object of cultivation, but it is long since Elderberry wine has not been used in the manufacture of genuine port wine.

Until not very many years ago, however, dried Elderberry used to be exported to Spain, Brazil, and France, and in 1866 the Oporto customs report an exportation of 180 tons of that article.

During the 77 years of the company's monopoly, the annual exportation of port wine amounted to 33,000 pipes, over 90 per cent. of which was shipped to England.

After an interregnum of a few years the monopoly was revived with a new company which regulated the export trade, and it is only 35 or 40 years ago that all restrictions were removed in either the manufacture or the disposal of the produce of the Douro vineyards.

One event, probably more than all Methuen's statecraft or Pombal's monopoly, helped to advertise the famous great wine of Portugal and establish it on the English market. During the Napoleonic campaigns, the maritime war between England and France had cut off the usual sources of wine, and Portugal, Britain's ally, supplied the produce of her vineyards. During the period Wellington's army was fighting in Spain and in Portugal the battles of the Peninsular war against the French, the strong wines of the South became more and more popular, and a taste sprang up for that wine, which forms the basis of a trade which has never since flagged.

The Paiz do Vinho.

After having been given an opportunity of visiting the capacious storehouses (*armazens*) of one of the largest Oporto wine merchants, a privilege which is not indiscriminately granted, I was invited to take a run up to the Upper Douro country, and visit some vineyards in the famous "Paiz do Vinho," the home of the port wine.

The railway line follows the course of the Douro and climbs up in an easterly direction the valley of that picturesque river which, issuing from the mountains of Old Castile, empties itself into the Atlantic a few miles below Oporto. It is at the border town, at Barca d'Alva, 500 feet above sea level, that the first vineyards are seen, but these are small as well as few and far between at that altitude. It is only some 20 miles lower down, where the Tua runs into the Douro, that the celebrated port wine country begins.

As we reach Pinhâo (pron. Pinyon) on the torrent of that name, some of the most famous vineclad slopes are met with. These extend some twenty miles or so to the Northward along the Rio Corgo, and to the Westward down the Douro, past Regoa, at the confluent of the Corgo with the larger river.

Altogether the patch of country found most suitable for the production of high-class Port wine covers an area extending forty miles along both banks of the Douro from East to West, and 15 miles from North to South, including the valleys of right bank tributaries of the Douro, among which are the Tua, the Pinhâo, the Torto, and the Corgo.

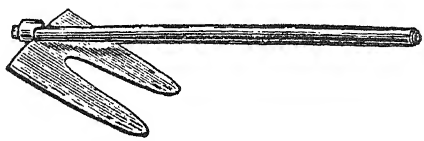
The geological formation of that patch of country is striking. It consists of a contorted mass of schistose slate, of silurian age, which is encircled like an island in the middle of an ocean of granite.

"Gallegos" at work with the prong hoe on schistose ground.

"Gallegos" and oxen ploughing. The pollards shown carry vines. The interval between the horns of the dun-coloured oxen is often a brace long.

It was around Pinhão that I had an opportunity of closely examining these rocks, which, under the influence of exposure to the climatic variations of untold ages, weather to clay, impregnated with particles of mica, quartz, hornblende, and other minerals, which, by the complexity of their constituents, harmonise into a fertile mass, made up of stones of various size and of fine soil.

As the formation is too rocky and the slopes too steep to permit of cultivation with the aid of horses or oxen, the stony ground is attacked by gangs of industrous "Gallegos" armed with mattocks or hoes with strong prongs instead of the cutting part; these dislodge large lumps of compressed mica-schist which are broken up into a friable soil by the heavy mass of iron on the top side of the hoe.



Portuguese hoe used on rocky land.

Men as well as women engage at this as well as other work. These "Gallegos" are a hardy and robust race of mountaineers. Although a thrifty, temperate, and hard working race, inhabiting the densely populated mountains of Galicia, they emigrate in numbers to Portugal and to South America, where, after engaging in all kinds of hard work and saving money, they return home and settle down. The women are quite as good workers as the men, and marriage with them is a partnership in which both partners share equally in the toils of the same occupation. These people, however, are devoid of independent spirit, and better servants than masters. They require overseers to direct them; a kind of occupation that suits the lazy southern Spaniard and Portuguese to perfection.

Without the sturdy "Gallegos" the rocky slopes of the upper Douro would, I venture to think, never have revealed the secret of its peculiar adaptation for the production of port wine. The average wage paid to a vine-dresser is 1s. a day, and to a labourer with the hoe from 7d. to 10d. On this they are expected to live, keep a family, and save money, with the idea of some day returning to homes in the mountains they love so well.

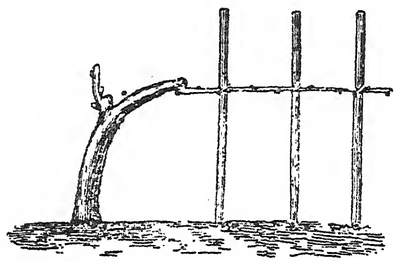
It is quite an interesting sight to see these "Gallegos" constructing the terraces on the face of the hills. With the larger pieces of rock they build up the containing rubble walls, after which the soft surface rocks inside are attacked by the mattocks, and more broken-up slaty clay is dumped into the hollow to bring the surface up to the required height. The soil is often thus prepared to a depth of three or four feet. Each terrace, as a rule, only carries one row of vines; and, with the wall, is eight to nine feet wide. These vines are planted about three feet apart in

the line. When the slope is easier, wider terraces may be constructed, and in that case two or more parallel rows are planted.

The modern vineyards are now grafted on *Rupestris monticola* or "du Lot," which is found to be one of the best adapted for the formation.

In Portugal, as in Spain, the practice is to mix the vines when planting the vineyard. This saves mixing the grapes when fermenting, and, it is claimed, a more homogenous wine is made.

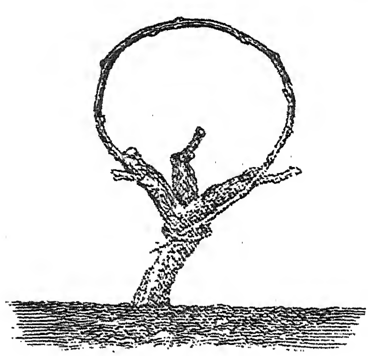
Unlike the practice generally adopted in many other parts of Portugal, where vines are allowed to climb up amongst the branches of trees, they are kept low on the Upper Douro.



Method of Pruning on the Upper Douro.

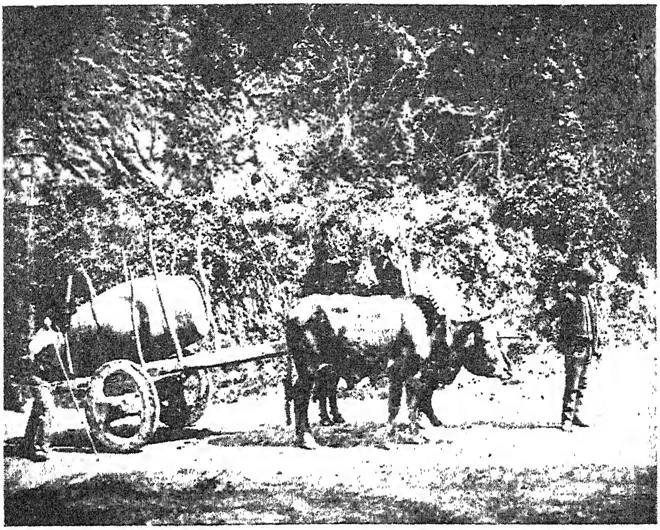
The weaker vines are each given a short spur and a long rod (Guyot system), whilst the stronger ones are pruned with two spurs and two rods according to the Medoc espalier system.

In other Portuguese vine districts, instead of tying the long rod on stakes or wires, it is, as is often practised elsewhere, twisted back in a loop, and tied to the stock itself. No

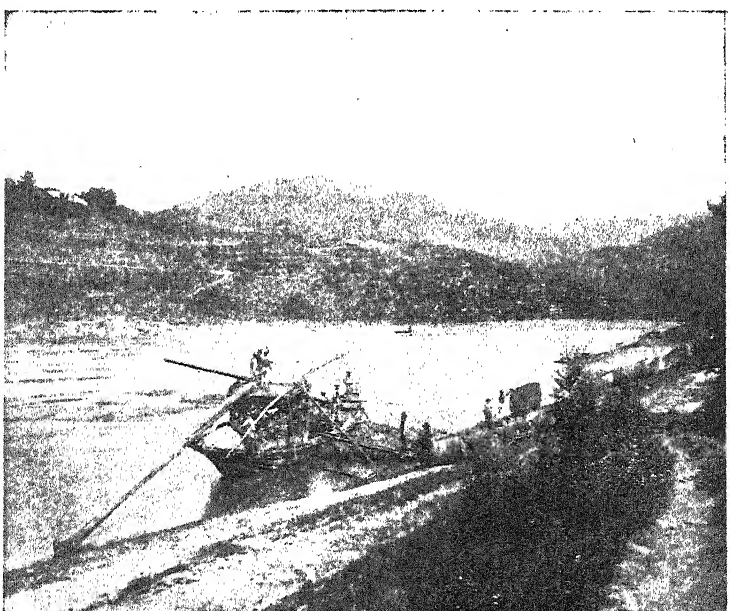


Long Pruning in Portugal.

fertilising is practised on the Upper Douro. Every few years, when the rubble walls are showing a tendency to crumble down under the weathering influence, the soft material they are made of



A pipe of Port wine being carted from the farmer's "Lagar" to the Douro or to the Railway Station.



"Barco Rabello," which brings wine from the Paiz do Vinho down the Douro to Oporto.

is reduced to earth with the mattock, and spread over the terraces and harder stones used in repairing them. It is contended that this continuous pulverisation that goes on adds to the soil fresh material on which the vine finds all the nutriment it needs.

This contention is supported by the following physical and chemical analysis given by Villa-Maïor, a Portuguese agriculturist, of a soil of Douro country :—

59·05 Gravel	Fragments of schist and silica.
25·36 Sand	21·82 Silica and silicates. 2·13 Oxide and phosphate of iron. 1·41 Carbonate of lime.
0·07 Vegetable matter	
15·36 Clayey soil ...	13·91 Clay. 0·33 Oxide of iron. 0·53 Lime. 0·08 Magnesia. 0·34 Carbonic acid. 0·17 Phosphoric acid.
0·46 Soluble salts ...	Organic substances, ammoniacal salts, Chlorine, sulphuric, nitric, and phosphoric acids, potash, soda, lime, alumina, and oxide of iron.

Wine Making.

Vintage was just commencing when we arrived at Pinhâo. Along the line, and at railway stations, long train-loads of empty pipes and spirit casks were passed. The grapes are picked on the Douro towards the latter end of September and in October. Arrangements are previously made by the wine merchants of Oporto for the purchase of the crop from the farmers, and on account of the almost insurmountable difficulties which nature opposes against the carting of grapes to long distances, it is found more convenient to despatch a cooper, who also understands the business of fortification, with the necessary amount of spirit to the farm, than to cart the grapes to the merchant's fermenting house.

Some of the Oporto wine-merchants own, amongst the picturesque slopes along the swift Douro, vineyards of great repute, and comfortable country houses and bungalows where they repair at vintage time, but a great many of the farmers live in their own hovels.

The grapes on the more exposed slopes are brought in first to the "Lagar," a Moorish name for fermenting house; they are a motley crowd of different varieties.

One of the best prized, the *Touriga* (pron. Touriya), is very sweet, black, and in appearance somewhat like the Cabernet of the Medoc, it is also a poor bearer. Amongst others I was also shown the *Tinta Francisca*, the second best grape, a good bearer, which like the *Tinta Cão* (pron. Cayon) is cultivated mostly for the sake of its colouring matter; the *Alvarelhâo* (pron. Alvareignon) a poor bearer and poor in quality ; the *Bastardo*, widely cultivated on the Douro; the *Mourisco preto*, a strong grower, partially phylloxera

resistant, and a round, blueish grape, loose on the bunch, requiring a warm spring to set well. That grape was familiar to me, being amongst some I introduced some years ago, and in my opinion will prove an acquisition to Western Australian vineyards in the warmer districts. I also recognised an old favourite Australian grape, the *Gonveio*, which is the same as the *Verdelho* of Madeira, and produces the finest white port of Traz-os-Montes.

All these grapes are brought in together, tipped into shallow fermenting tanks, generally made of slate or of granite. They are there trodden into a pulp and thoroughly aerated.

The trodden grapes are allowed to ferment for a couple of days, and the half-fermented wine is run either direct into large casks below, if gravitation permits it, or is pumped into them where the "lagars" are not constructed on a slope.

These large casks hold 15 to 25 *pipas* (pipes) of 115 gallons each. The skins are meanwhile pressed, and the juice likewise runs into the larger casks.

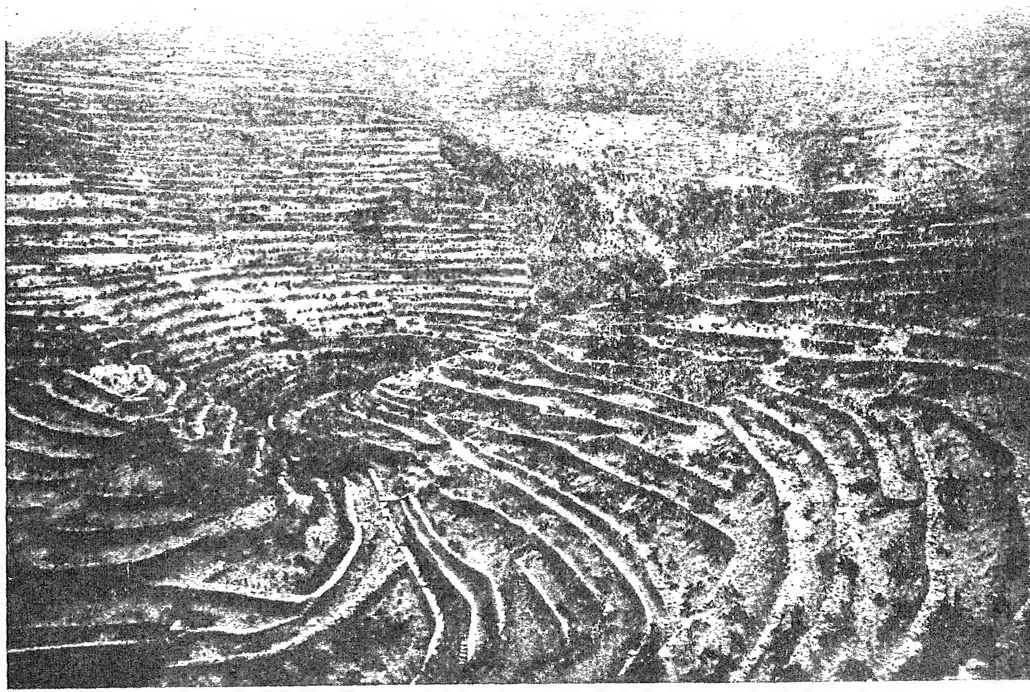
There fermentation is checked by a sufficient addition of rectified spirits. According to the richness of the must in sugar, and to the degree of alcohol already produced by fermentation, about 15 gallons of 80 per cent. spirit for each pipe of wine in the large cask is there and then added. In other words, the partly fermented wine receives an addition of 11 to 12 per cent. of alcohol. This checks the fermentation and stills the wine which is allowed to rest, then, when convenient, during the winter or the early spring, the new port wine is sent down from the up-country places to the merchants' central depôts which have easy access to the railway line or to the river.

Thence the wine is taken to Oporto, partly by rail, partly by river. The boats which are used for that purpose *(Barcos Rabello)* are strongly jointed flat-bottomed barges, which, laden with pipes of wine, drift with the current and steered by means of an enormous rudder, shoot the numerous rapids which occur on the Douro.

On the country roads or the paved town streets, a familiar sight are the creaking oxen carts, with wooden axles and solid wooden wheels. These are drawn by large, muscular, dun-coloured oxen, with enormous horns. The distance between the horns from tip to tip is often a brace. These oxen are often driven by young girls or women. All this traffic is conducted with little or no shouting and cracking of whips, compared with Algerian or south of Spain habits.

On arrival at Villa Nova de Gaia, the different shipments of port wine are sampled, classified, and blended in enormous vats, where a further small addition of spirits permanently checks, if found necessary, any possible further fermentation.

The Port wine is then stored in pipes of 115 gallons, or in larger casks if found convenient, and left to mature until time has mellowed down the harshness derived from the tannin of the grapes



Schistose-slate formation of the "Paiz do Vinho" worked into terraces, once under vines, since destroyed by the phylloxera.

or the fieryness caused by the successive addition of spirits. Long keeping in bottles further assists in softening the taste of spirits, and in imparting to the wine both roundness and bouquet.

Before shipping, the likings of each particular market have to be satisfied. Some prefer a tawny port, others a darker wine. Again, there are degrees in the sweetness and in the strength of the wine shipped abroad; for the British market, which comprises the colonies, the port wine generally receives a further admixture of spirits before leaving, and it is also often sweetened up with Jeropiga, a highly fortified wine of a syrupy consistence.

It is a fact worth noting that whereas port wine seldom contains less than 35 per cent. proof spirit, it generally averages 39 per cent., and much that finds its way to England contains as much as 42 per cent. and more. These heavy additions are often made to the lower quality wines, which are thus quickly and without risk made ready for shipping to the class of market it is meant for.

Port wine, it is thus seen, is a highly complex wine, made from the juice of a great variety of carefully selected grapes grown on soil apparently barren, but nevertheless fertile, and partially fermented in a sort of haphazard way with varying degrees of alcohol and sugar (5 to 10 per cent. of the latter). Both during the process of fermentation and afterwards, the wine is subjected to thorough aeration, and is then blended, and if necessary further fortified until the required standard aimed at has been reached.

As regards value, all classes of customers may be accommodated, the prices ranging from £10 a pipe (2s. a gallon) to £50 (9s.), and more for old wine of special merit, but, as a rule, very good value is got for £30 to £35 per pipe (5s. to 6s. per gallon) at Villa Nova de Gaia.

NOTES ON TABLE POULTRY.

By Frank H. Robertson.

I have been making inquiries among the largest buyers of poultry in Perth with the view of obtaining reliable information as to the state of the trade, and in particular as regards the quality and quantity of the supply. On interviewing one of the largest dealers, he informs me that the local market is deficient in both respects. Just as regards the quantity, there is considerable difficulty in obtaining a sufficient quantity of the quality suitable for his customers, as last December he had to import about £600 worth of fowls, and he estimates that he imports about £2,000 worth in the 12 months. This is only one buyer's demands, and as there are several others in the trade who import largely, the total sum leaving the State for this purpose probably amounts to something like £10,000 per annum. There is a large consumption of poultry in Perth, one

hotel alone uses, on the average, about 15 pairs a day, or about 11,000 head in the 12 months. From these few figures it will be seen that there is an excellent local market always ready to buy all that is offered.

Then, as regards quality, there is much room for improvement in this respect. It is but seldom that really first-class table poultry are to be seen in the auction rooms and markets. It would, perhaps, be wrong to say quality, because such is not really what is wanted; the demand is for big birds. The West Australian taste is not of epicurean order. The plump and delicate-flavoured chicken of two or three months, specially bred and fatted, such as is wanted for the American, French, or English markets, is hard to sell here. Some day, no doubt, the demand will arise for this toothsome article of diet so eminently suited for our climate, but at present there is wanting both the taste and appreciation of such food.

As a general article of diet—due probably to the small proportion of our population who are willing to pay a sufficiently satisfactory price for the luxury of grilled or boiled chicken—the following extract from the letter of a London importer to a Canadian produce company will give a good idea as to what is required for the English market:—"I might say that the three-pound bird, which means the same thing as the three months old bird, is what is wanted. In fact, we can sell a dozen chickens weighing from 30 to 40lb. per dozen to one of all other sizes, and the preference is given to small and young birds of large breeds rather than to the same weight but mature birds of smaller breeds; the call is more than ever, however, for quality."

If any of our chicken raisers should think of trying the London market, the above will tersely explain what is wanted; but with the good local market right at our door, it is not worth while at present to look further afield.

For the poultry raiser who has to buy all his feed there is a very small margin of profit to be made out of poultry for the table, but good money in egg production. To the ordinary farmer, who raises all his own grain and feeds his fowls among the stubble and waste grain, the profits in poultry for the table are probably larger here than in any other part of the world.

The prices vary much, and to get the best results the producer should pay more attention to this matter. Some three months ago such prices as 8s. a pair for large young cockerels and 10s. for ducks were not uncommon, but of late the market has been over-supplied with birds too young, which fetched poor prices, and also brought down prices all round. It is a mistake to send in chickens two or three months old. There is no demand for them. If these birds had been kept for another two or three months they would have met a better market, and likely to fetch very satisfactory prices. The chief fault, no doubt, is in late hatching. If chickens are hatched in June and July, they will come in for the Christmas market. My informant tells me that poultry are likely to fetch much better prices from now up to Christmas.

As the demand is for big birds, it would be wise to keep the breeds that are likely to fetch the best prices; and for this purpose, if pure birds alone are not kept, at least let the small birds be such varieties as the Plymouth Rock, Orpington, or Wyandotte. In addition to improving the table qualities of the flock, they are good layers. The Malay or Indian Game would be even better for producing table birds, but as they are poor layers the general flock would suffer in this respect, therefore the first-named breeds are to be preferred. If the whole of the flock were composed entirely of one or other of these pure breeds the results should be still more satisfactory, but as there is a prejudice in many quarters against quite pure stock, a good plan would be each season to introduce fresh cockerels, always keeping to the same variety. By this means the flock could be graded up in the course of a few years to almost equal to quite pure stock.

The grading of the poultry sent to market is another matter that is worthy of more attention. The price of a crate of good young cockerels is often very much spoilt by the inclusion of a few birds of indifferent quality, and, worse still, if one or two should show signs of disease such as catarrh or roup, the buyer's attention is immediately drawn to the diseased or inferior birds, and a lower all-round price is the result. A small matter such as grading according to colour is also worth considering. Let all the white birds be sent in one crate, all the black in another, and if there are brown ones let them go by themselves; at the same time paying attention to age, size, and condition; for instance, a crate of white Wyandotte cockerels of, say, an even weight of 5 to 6lb. each, would catch the eye of the buyer, and fetch a better price than another crate composed of good birds but of all colours and ages.

The purchasing of poultry by weight would be greatly preferred by the principal buyers in the Perth markets, and would no doubt be the most satisfactory mode of selling, both for the vendor and the buyer. If producers were to mark on the crates the weight either of the lot or the average weight per pair, enhanced prices are almost sure to result, provided the stock is young and otherwise of good quality. It only wants a few vendors to sell at these guaranteed market weights, and the practice would soon become a general one. The grower often complains that, after having gone to the trouble of placing on the market fowls of unusual weight and quality, extra returns have not been the result, but that scrubbers, sent some few weeks previously or after, have fetched quite as good prices. Such no doubt does happen, but the market may have altered, or the good birds may have been badly shown, or struck a glutted market. With good handling, and sold at the right time of the year, with marked weights, good stock will fetch the top market prices. The auction sales are run through smartly, and the buyers frequently do not have sufficient opportunity to properly handle and inspect the stock they are buying; but suppose they see a nice, bright, healthy-looking lot of birds, put up at a guaranteed weight of, say, 14lb. per pair, the dealer or hotel-

keeper knows exactly what he is buying, and bids accordingly. He can see the outside appearance of the birds, and when he knows their number and weight that is all he wants to know. Of course the vendor must be quite honest in his marking, and the auctioneer should also be instructed to announce the weights when selling. The ticket attached to the crate should be clearly and distinctly marked and initialled by the owner, so that the buyers can easily see what the weights are. If this system of selling by weight, combined with some care in grading, were adopted, the producer would find it to his advantage; but it rests with the vendor to introduce the system, as the buyer or agent would neither have the time nor opportunity of weighing before the sales are made.

TUBERCULOSIS IN DAIRY CATTLE.

By R. E. Weir, V.S., C.I.S.

Many cases of tuberculosis have been discovered recently within the suburban district, principally amongst dairy cattle. It is therefore deemed advisable to issue this precaution to owners of herds engaged in this industry. It should be generally known that any suspicious infectious sickness must be immediately reported to the Stock Department, a heavy penalty being provided for defaulters in this direction. An animal affected with tuberculosis usually exhibits unmistakable symptoms of the complaint, which are as follow :—

Generally, the earliest signs are: falling off in condition, a slight cough accompanied by general dullness of spirits, and swelling may or may not appear about the throat. There is no diminution in the milk supply for some considerable time, though in time it becomes blue and watery. The skin looks dull, and is tightly bound down to the tissues below; the coat feels harsh and dry. Towards the latter stages the cough becomes very troublesome and apparently painful, as depicted by the arched back. The animal obstinately refuses to move; the head is held low, nose protruded, mouth held open with a free flow of saliva, the tongue hangs loose, and the ears droop, the animal having a very dejected appearance.

It is, perhaps, unnecessary to dilate on the consequences of allowing milk from infected animals to go into human consumption, for it is well known that tuberculosis is one of the most easily communicable diseases that flesh is heir to. Investigations as to the heavy infantile mortality in this State go to show that many are traceable to milk impurities. It will therefore be readily seen that by the distribution of milk from infected dairies such diseases as the above are being propagated in an extensive manner.

FRUIT FOR EXPORT.

By A. Despeissis.

With the rainy season fruit planting will shortly occupy the attention of settlers, old and new. To a great extent the success of these anticipated orchards depends in the first place on the selection of the varieties of fruit to plant, and, incidentally, on the market to serve; the adaptability of soil and climate in the different localities concerned should also influence the selection to be made of the tree.

In most instances, however, there are certain kinds of stock varieties, which have proved to be well suited for the local as well as the export market, which it will be safe to plant, irrespective of other varieties the orchardist may have a personal liking for.

In order to draw attention to the most suitable varieties to ship, the Department of Agriculture sent several years ago to our Agent General in London several trial consignments of our orchard fruits. These were packed by the growers themselves, and on arrival in London, Sir Edward Wittenoom submitted them to one of the leading firms of fruit brokers of Covent Garden, for their report and suggestions.

Among the varieties more particularly praised by Messrs. Kealing & Hunt, the fruit brokers, were the following apples:—

Jonathan	Scarlet Pearmain
Cleopatra	Scarlet Nonpareil
Rome Beauty	Bismark
Esopus Spitzenburgh	Stone Pippin
Five Crown Pippin	Rymer
Dunn's Seedling	Shockley

Of pears, the following, when picked at the right stage and packed in shallow boxes and carried by themselves in well-ventilated and cooler chambers than required by the apple cargo, will carry well and sell readily at profitable prices, viz.:—

Bartlett	Winter Nelis
Beurré Clairgeau	Josephine de Malines
Beurré d'Anjou	Broompark
Glou Morceau	L'Inconnue
Vicar of Winkfield	Keifer's Hybrid

Citrus fruit, of all fruits, carry best, more especially oranges, of which those which should deserve special attention are—

Washington Navel	Mediterranean Sweet
Jaffa	Siletta
St. Michael	Valencia Late

Stone fruits are too precarious to command attention as fruit for the export market, although with the marked tendency for more

speedy passages, great possibilities lay in store for such fruit as the Japanese plums and some of the more fleshy prunes.

The same may be said of grapes, of which one, the Daira or Ohanes grape—more commonly known as the Almeria grape by our growers—is an example. Some more, almost as good, I have recently introduced, and I hope this department will, before long, be in measure to distribute plants and cuttings for propagation.

In another paragraph some information is given of a trial shipment now being made to test the value of a promising Australian seedling as a long-keeping and a good carrying grape.

A SEASON WITH THE "WOODEN HEN."

By L. M. H.

It was not because of any desire to test the efficiency of incubators that I launched forth into the business of artificial incubation, neither was it for the purpose of comparing results with the ordinary methods of hatching, but because there hovered before my eyes a dazzling vision of the huge profits to be gained by having fowls that would lay eggs at the right season of the year. To compass this the first requisite was early hatches. Now I knew very well that as my hens were somewhat of the Leghorn persuasion, it was useless to look to them for assistance, save to supply the eggs required. The outcome of the matter was that I began to read everything relating to incubators that came within my reach until I finally resolved that an incubator I must and would have. After due deliberation more in consideration for my purse than to the merits of the incubator, of which I knew nothing, I purchased "The Wooden Hen," not because it looked at all like the real flesh and blood article, for nothing farther from the genuine could well be imagined, but its name took my fancy, and the price was reasonable. It is made by Geo. Ethall, of Illinois, United States, America. It is heated by a water tank with lamp attached. On its arrival I spent a couple of days in studying the instructions; I then filled up the tank with hot water and lit the lamp. I ran it thus for a couple of days until I found I could regulate the temperature fairly well, when with some qualms—eggs were selling for 3s. 6d. per dozen—I entrusted my eggs to the receptacle or egg-tray. The first three days I spent the greater part of my time watching the incubator, and then as it showed no disposition to explode and set fire to the premises, and as the temperature remained within the bounds, I gradually relaxed my vigilance and was able to perform my household duties in a more or less efficient

manner; also able to secure a much needed rest upon retiring, not rising more than a couple of times during the night to see that all was well. Testing the eggs upon the fifth day I found one infertile egg, which I removed. On the eighth day, tested again and found 10 more infertile eggs, which were also removed. I forgot to mention that in the beginning I had placed 42 eggs in the incubator. As the hatch progressed I found it necessary to adjust the regulator frequently as there was a tendency toward too high a temperature. During the last week of the hatch my hopes for success received a sudden check, as I found I had not mastered the instructions fully, having only turned the eggs once a day instead of twice. However, on the 20th day I was rewarded by the appearance of a fine healthy little chick, though, to be quite truthful, I thought at the time that it was a miserable, squirming, bedraggled-looking little creature, never having seen one quite so young before. On the 21st day I had the satisfaction of finding 24 chicks, all strong and robust, making $77\frac{1}{2}$ per cent. hatched from the fertile eggs. I then put in a number of duck eggs, and in a week's time filled up with hen eggs—result, 80 per cent. hatched. Refilled with hen eggs—result, 85 per cent. hatched. Of this last hatch there were a dozen eggs which I had purchased from a fancier, and as they were not a success they brought down the average. From eggs from my own stock there hatched 34 from 36 fertile, which was the record hatch of the season. I continued hatching until the middle of January, but this last was not a success, only 50 per cent., though, of course, it was not to be wondered at, for the outside temperature was so high that some days I had to remove the egg-tray five or six times to prevent the eggs from being over-heated.

I would mention that the incubator was run in a brick building, which I consider is preferable to any other as the temperature is not subject to such sudden changes as in a tin, wood, or canvas building. Since that time I have met with admirable results from the use of asbestos roofing. Of course, no matter what the material of building, there must be little or no draught.

I believe that anyone, imbued with a fair degree of common-sense, could run any of the average machines on the market with profit, providing they could secure a supply of newly laid eggs from vigourous, healthy fowls. I merely mention the necessity of fresh eggs because there seems to be, in the minds of some persons, a belief that an incubator is warranted to hatch from anything in the shape of an egg, be it an infertile or an addled one.

To the Editor.

Sir,—I notice in "Notes" in the *Journal* that you request information *re* Incubators. I have run several hatches in two incubators, one a No. 0 Special, the other a No. 3 Special, both made by the Prairie State Incubator Company, of 60 and 360 egg capacity respectively.

I hardly feel qualified to give you any information yet, as they have been working under most unfavourable circumstances in a small iron room, subject to drafts and great variations in the external temperature.

However, even under these conditions they have hatched out over 50 per cent. of fertile eggs, with fully another 30 per cent. fully formed, but dead in the shell, caused, I am convinced, not by any fault of the machine (which kept a remarkably even heat whilst external temperature did not exceed 90 per cent.) but by excessive external heat as often, with the lamp out and doors open, I could not get the temperature of the machine below 104 or 105 degrees for hours at a time.

I shall be running a "Petaluma" shortly, as well as these two under better conditions, and if of any value to you, any information or experience I may obtain is at your service. In the meanwhile I may state that, from personal observation, I am convinced there is no machine to touch the "Cyphers," and any more I need I shall obtain from them. Though they do not hatch out appreciably larger percentages than the "Petaluma" or several other leading makes, the chickens are far and away healthier, which means less trouble in rearing and a much lower death rate.

Mr. Cecil Piesse, of this town, can probably give you as reliable information on this subject as anyone in the State, as he has run a good many different makes of machine.

Trusting this may be of some use to you,

E. A. B.

To the Editor.

Sir,—In your issue of the *Journal* you ask for "Experience on Incubators." I have used incubators for the last six years; I might here say I do not think poultry farming could be made payable without incubators. I have hatched from 400 to 500 pair in a season. The best time I find is from March or April till October, although I have worked the incubators all the summer; they hatch well, but the chickens do not grow so well in the hot weather. The incubators were in an iron room, eight feet high and 12 x 12. The incubators I use are Hearson's Champion—a Tamline Nonpareil. I have never used foster-mothers, nor have I ever used eggs to feed anything I hatched. I might tell you, when the weather was hot, I used to put the lamp out and let the water in the tank cool down.

Yours, etc.,
M.N.

To the Editor.

Sir,—In compliance with your request contained in the latest issue of the *Journal*, I have much pleasure in informing you that during this season I have been using two incubators, 100 eggs

each, one an Australian and the other an imported Hearson's English machine, both fitted with hot water tank. Without hesitation I give the preference to Hearson's incubator, which is absolutely self-regulating, giving no trouble whatever—a perfect machine.

Yours, etc.,

M.T.

P.S.—As you are probably aware, there is a very large poultry farm at Kalgoorlie, working 11 incubators, some of which hold 300 eggs each. It would be interesting to your readers to learn the result of the experience on said farm.

[While thanking the writers of the above letters for their kindness in writing, we would suggest that more details would be acceptable, such as appear in the first of these letters from L.M.H., so that they may prove of value to those who are trying the "Wooden Hen" for the first time.—Ed. *Journal.*]

A NEW APPLE.

By A. Despeissis.

The varieties of cultivated apples are computed by the hundred. While all sprang out from a common tree, Nature has so modified the original stock that innumerable kinds are now known to pomologists. Most of the varieties we chiefly cultivate we have borrowed from sources where the natural conditions are somewhat similar to ours; others, and some of the best, are Australian seedlings. These thrive to great perfection with us and therefore deserve more than passing attention.

One particularly promising variety was brought under my notice a few days ago by Mr. J. S. Parke, of Donnybrook, who created the variety, and called it the "Western Belle."

It is the result of Late Wine pollen on Northern Spy pistil. For that purpose the pollen sacs of the mother plant were clipped off when immature, and after fertilisation the flowers were covered with fine gauze. This was done in 1895, says Mr. Parke, at Warragul, in Gippsland. The pips from the resulting fruit were sown the subsequent year, and in 1897 the young seedling, along with others, was brought to Western Australia and planted, where it now grows at Donnybrook, in the Blackwood.

The tree, which is the most thrifty in the young orchard, bore a few fruit five years after planting, rather more the next year, and quite two cases this year. It is more spreading than the Northern Spy, and has a similar leaf. The soil in the orchard is a sandy loam, overlying clay at a depth of four feet.

In appearance the fruit is not unlike the Esopus Spitzenburgh, which is also related to the Northern Spy, but it is more striped, and in that respect more like the Northern Spy.

The following is a full description of the fruit:—

Form: Round, oblate-conic.
Size: Large, 3 inches by 3¼ inches.
Stalk cavity: Shallow, with a lip, and lined with russet.
Stem: Short and stout, with a small protuberance.
Basin or "blossom end": Shallow, regular.
Calyx: Small, closed, erect segments.
Colour: Yellowish background, splashed all over with red stripes.
Bloom: Oily.
Flesh: Crisp, juicy.
Core: Large, open.
Flavour: Sub-acid.
Quality: Very good.
Season: Early Autumn, follows Jonathan.

This apple, it is thus seen, is earlier than the Northern Spy, more fruitful when young, and participates in the qualities of both parents. The specimens submitted are rather larger than a good export apple should be; but it is more than likely that as the tree gets older and in heavier bearing, this excessive quality will be corrected. This apple presents many good points, and is well worth the attention of our orchardists.

WHEAT RETURNS FOR WESTERN AUSTRALIA FOR THE SEASON 1903-4.

In furnishing the returns, herewith, the Registrar General points out that when publishing the preliminary comparative figures for the season 1902-1903 and 1903-1904 it was found to be necessary to confine the return to the boundaries of the magisterial districts, and in the case, amongst others, of Northam, Toodyay, and Swan, the only way to obtain any comparison with figures of previous years, owing to recent alterations in the boundaries, was found to be to combine the three districts together.

Wheat Returns for Western Australia for the Season 1903–4.

Magisterial District and Police District.	Season 1903–4. Area under Wheat for grain.	Total Production	Average Production per Acre.
	Acres.	Bushels.	Bushels.
Blackwood—			
Donnybrook	10	120	12·00
Greenbushes	19	223	11·74
Bridgetown	374	3,091	8·26
Total	403	3,434	8·52
Williams, Katanning, and Plantagenet—			
Williams	1,780	17,961	10·09
Broome Hill	3,481	28,073	8·06
Wagin	8,823	88,342	10·01
Kojonup	2,189	15,639	7·14
Katanning	14,748	140,817	9·55
Narrogin	8,507	101,779	11·97
Mount Barker	904	7,979	8·83
Total	40,432	400,590	9·91
Murray—			
Pinjarra	38	392	10·32
Perth	25	375	15·00
Sussex	70	699	9·99
Northam	23,495	386,060	16·43
Swan—			
Swan	38	360	9·47
Gingin ... ... }	2,058	28,812	13·80
Helena Vale ... ... }			
Total	2,096	29,172	13·92
Phillips River	20	120	6·00
Toodyay—			
Toodyay and Newcastle	15,592	208,186	13·35
Moora	3,920	54,880	13·56
Total	19,512	263,066	13·48

Wheat Returns for Western Australia for the Season 1903–4—continued.

Magisterial District and Police District.	Season 1903–4. Area under Wheat for grain.	Total Production.	Average Production per acre.
	Acres.	Bushels.	Bushels.
Victoria and Northampton—			
Dongara	3,853½	47,501	12·32
Greenough	5,394½	58,821	10·90
Geraldton	1,382	14,331	10·37
Mingenew	540	7,635	14·14
Northampton	1,310	15,172	11·58
Total	12,480	143,460	11·50
Wellington—			
Donnybrook	101	1,162	11·50
Collie Fields	27	360	13·33
Yarloop	73	730	10·00
Bunbury	314	3,646	11·61
Total	515	5,898	11·45
York—			
Beverley	18,968¾	341,455	18·00
York	18,640¼	324,829	17·43
Total	37,609	666,284	17·72
Grand Total	136,695	1,899,550	13·90

The following is a Comparative Statement of the Wheat Harvest in Western Australia for the Seasons 1902–3 and 1903–4:—

Magisterial District.	Final Figures—Season 1902-3.			Preliminary Figures—Season 1903-4.		
	Area under Wheat for grain.	Total production.	Average production per acre	Area under Wheat for grain.	Total production.	Average production per acre.
	Acres.	Bushels.	Bushels.	Acres.	Bushels.	Bushels.
Blackwood	380	4,539	11·94	403	3,434	8·52
Collie	6	60	10·00	...	...	...
Dundas and Esperance ...	8	100	12·50	...	...	...
Fremantle and Perth ...	51	690	13·53	25	375	15·00
Katanning, Plantagenet, and Williams	25,494	291,473	11·43	40,432	400.590	9·91
Murray	81	784	9·68	38	392	10·32
Northam, Swan, and Toodyay	30,954	269,371	8·70	45,103	678,298	15·04
Phillips River	30	150	5·00	20	120	6·00
Sussex	85	958	11·27	70	699	9·99
Victoria and Northampton ...	8,500	73,127	8·60	12,480	143,460	11·50
Wellington	488	5,552	11·38	515	5,898	11·45
Yilgarn	2	25	12·50	...	...	...
York	26,319	338,730	12·87	37,609	666,284	17·72
Total	92,398	985,559	10·67	136,695	1,899,550	13·90

FEES FOR ANALYTICAL WORK.

The Hon. the Minister for Lands has approved of the following Scales of Fees:—

For general public and vendors of fertilisers and feeding stuffs—Scale I.

For *bonâ fide* farmers and gardeners—Scale II.

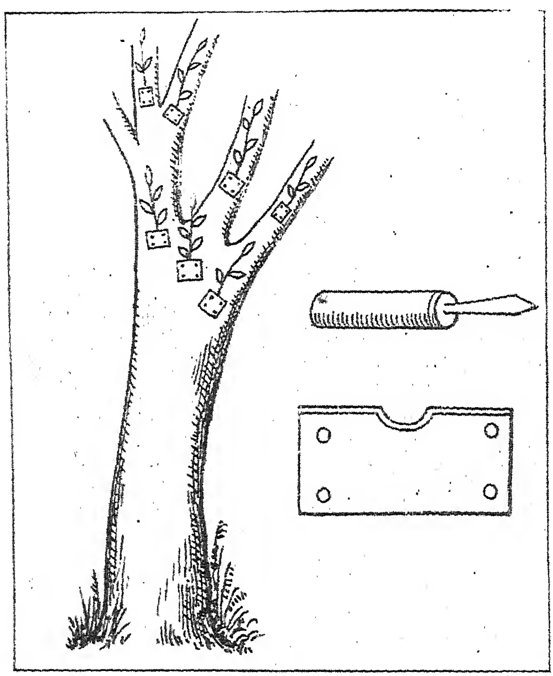
	Scale I.			Scale II.		
FERTILISERS AND FEEDING STUFFS—	£	s.	d.	£	s.	d.
Estimation of Nitrogen	0	10	0	0	5	0
" Potash	0	10	0	0	5	0
" Water soluble phosphates	0	10	0	0	5	0
" Citrate	0	10	0	0	5	0
" Insoluble phosphates	0	10	0	0	5	0
" Lime	0	10	0	0	5	0
" Sulphate	0	10	0	0	5	0
Complete analysis	1	10	0	0	15	0
Albuminoids	0	10	0	0	5	0
Oil	0	10	0	0	5	0
Fibre	0	10	0	0	5	0
WATER—						
For irrigation	1	0	0	0	5	0
Complete analysis	3	0	0	1	0	0
SOILS—						
For each soil	2	0	0	1	0	0
For soil and sub-soil submitted together	3	0	0	1	10	0

A NEW METHOD OF BUDDING.

An interesting letter has been written to the Department by Mr. J. Bell, of Balmain, New South Wales, on a new method of budding. In his letter Mr. Bell states: "I might mention that my method of budding was totally unknown to the Government botanist and fruit expert, both of whom have expressed their appreciation of the discovery, and have promised to make it known to orchardists and others that it might interest." The following is a clipping taken from the *Australian Field*:—

"An interesting experiment by Mr. J. Bell, of Balmain, has led to the discovery of a simple and highly successful method of

budding. The procedure is thus described by Mr. Bell:—'I have a large peach tree in my yard, measuring 23in. in circumference at the base, and at 6ft. from the ground, 18½in. It is 10 years old, and last year I experimented with it as follows:—I sharpened a piece of bone to the shape of a lead pencil, and fixed it in a handle, providing a tool like a large carpenter's awl. The handle of a tooth brush will answer as well as anything, and by putting a handle on it may be driven with a hammer into the bark. Bone will not "turn" the sap like steel or iron. After making a sufficient hole in the bark I insert the bud, and then tack a piece of leather on to keep it in its place, using upholsterers' half-inch gimp pins, which, being enamelled, do not rust. Several buds were so treated, and when they swelled the



tacks were loosened, so that the leather could be removed easily. Wedge grafts of six inches were done in the same way, but I found that on my tree the buds grew much more quickly and stronger than the grafts. I inserted eleven buds of three different varieties of the peach on this tree, and they are all bearing large and excellent fruit this season, some of the buds having as many as 60 fine peaches. I would recommend the adoption of this method for all old trees requiring new wood, an advantage being that it does not interfere with the tree bearing fruit while the buds are being matured. No string or clay or grafting wax is required, as with the old system.'

"The accompanying illustrations show respectively the tree which has proved the efficacy of the method, and the diagram representing the awl and the correct way to tack the leather on the buds.

"This method can be applied to the old T system of budding by tacking wet sole leather over the buds, with space for its growth, instead of using string, etc. First puncture holes in the leather for the gimp pins, so as not to bruise the bark or bud. The proper time is when the sap is full and bark will strip easily."

Mr. Despiessis, the horticultural and viticultural expert of the Department of Agriculture of this State, in speaking of the above method, states:—"This is an interesting application of the methods of budding—grafting. Cutting the tree back and operating on the young shoots in the usual way would, of course, result in a better knitting of the scion and stock. In Mr. Bell's method, however, the point which is worthy of attention is that the productiveness of the tree is not interrupted."

SHIPMENT OF GRAPES TO LONDON.

Report by A. Despeissis.

In accordance with previous arrangements, a small consignment of grapes was sent by the M.S.S. "Mongolia" on the 11th inst. to the Agent General in London. The Agent General has been requested to have the grapes submitted, on arrival, to some reputed importer of grapes from Almeria, in London, and to ask for a report as regards the condition the grapes arrived.

The consignment consisted of thirteen cases. Twelve cases contained the "Bridal" grape from Mr. Ch. Cook's vineyard, near Chidlow's Well, in the Darling Ranges. The object of the experiment is chiefly to test the keeping quality of this particular grape, which is an Australian seedling of great promise.

The thirteenth case contained some Daira or Ohanez grape, which is the favourite grape for exportation, shipped from the port of Almeria, in Spain, to England and to America. These grapes were obtained Mr. Ch. Harper's orchard at Woodbridge. They were selected on account of their good carrying quality in order to afford a means of comparison whereby to judge the same characteristics of the Bridal grape.

The cases were not all packed alike. The witness Daira case was packed in an ordinary fruit case with three compartments and with the cleats nailed close. The compartments were lined with paper, and the bunches with all defective berries clipped off, were solidly packed in clean cork dust. The case was only covered and nailed down a day and a-half after picking and packing to allow a certain amount of sweating.

Of the Bridal grapes, some were packed similarly, Mr. Cook using brown paper for lining the boxes. Others were packed with the bunches in rice-paper bags, with the cavities filled in with cork dust. One case was packed without any packing material, as is customary when sending grapes from the coastal districts to the goldfields.

In this instance the grapes had been picked the day previous to packing, in order to wilt sufficiently. On board the steamer they were placed with the rest of the fruit cargo in the cool storage chamber.

Two disturbing elements may affect this trial; the grapes were somewhat over-ripe and the rain which fell lately had, to some extent, injured them. All the unsound berries, however, were snipped off the bunches, and they were handled and packed with all reasonable care.

Those cases in which the grapes were packed in cork dust weighed, gross weight, 35 to 37lbs., the cases weighing 7 to 7½lbs.; the grapes 25 to 27lbs., and the cork dust and packing paper 3 to 3½lbs.

The case packed with Bridal grapes by themselves weighed 43lbs. gross, and contained 35¾lbs. of grapes.

DAIRYING IN THE SOUTH-WEST.

By W. C. Grasby.

The problem of establishing a dairy industry in the South-Western country presents many factors differing materially from those which have to be considered in the Eastern Districts, of which Newcastle, Northam, and Beverley may be considered as typical.

The main conditions are:—

(1.) A heavy winter rainfall with a dry summer season, during which little or no rain falls. In this it corresponds with the East, except that on the coast the rainfall is much heavier.

(2.) The presence of tea-tree peaty swamps and of large areas of low, flat, sandy country, more or less heavily timbered with red gum and banksia and overgrown with coarse scrub or herbage. In the winter months these areas are practically under water, but for part of the summer, at all events, are moist enough to grow thousands of acres of maize, sorghum, and such like summer crops.

In thinking over the development of the dairy industry I am led to the following conclusions, which I give as suggestive, but possibly subject to amendment in detail:—

The country, especially such as that near Busselton and Bunbury, is capable of at once supporting a number of first-class butter factories, while the lands nearer Perth should, I think, provide an unlimited supply of milk and cream for Perth and Fremantle. In saying this, I do not wish to cast reflections on what has been done or not been done in the past. The developments of this State have been so rapid that it was but natural that progress should be along the lines of least resistance. I am thoroughly impressed with the immense possibilities of the country, but I fully realise the difficulties which have to be overcome; and I am surprised to find how much the people have done under the adverse conditions under which they have worked.

It is perfectly easy for one to assume the air of the superior person, and from the widow of a railway train, or in a comfortable smoking room to lay down the law with a finality of a Nabob, as to what the people on the land should do. Such critics have not been absent from Western Australia; I have met a few of them myself. One can wish such good folk no worse fate and no better exercise than to clear a Blackbutt flat or drain and bring under intense cultivation a good tea tree swamp. The discipline would prove morally and physically healthy, and the exercise of the body more useful than that of the tongue.

But the fact remains that Nature always makes compensations, though they may not be at first apparent on a sand plain, and difficulties are but to be overcome. The climate and soil conditions which produce the heavy timber and dense scrub, are just the conditions which may be made to produce the fodder for the support of vast herds of deep milking dairy cattle. According to the work so should the reward be, and, I think, rightly directed, generally is. The trouble is to get the reward near enough to the work; it sometimes has the faculty of dodging the father and settling on his grandchildren, or may be the man who holds the mortgage.

The future developments must follow somewhat in the following order:—

1. The utilisation of the well-drained river lands, and such of the less swampy land as is already ready or almost ready for the growth of fodder. Now that hay shows a tendency to come down to prices which do not leave big margins, I think it will be found

more profitable here, as it has been in the wetter districts of the Eastern States, to grow green summer fodder for cows and stock rather than hay. The land which will produce a moderate crop of hay will yield a great quantity of ensilage, because when oats, barley, and peas, or tares are sown together, the one helps the other, and the result is a dense tangled mass of the most nutritive food stuff, which, when made into ensilage, can be kept indefinitely, and will go further than when used green, because the fermentation in the ensilage pit seems to increase the digestive ratio. It is really surprising, and can hardly be understood until tested, how much stuff will come off an acre of such mixed crop as I have suggested. I think my brother and I were the third to adopt ensilage-making in South Australia, and as our country, like the South-West District, was at one time densely timbered, and is so wet in winter that it has to be drained, I am merely writing of actual experience under somewhat similar conditions, and am quite sure that if the suggestion is carried out the results will not be disappointing. I will deal with the making of ensilage pits later.

2. *Drainage of Wet Lands.*—The opinion I have formed is that the larger portion of the coastal South-Western lands can only be properly utilised after drainage. I am referring not only to the swampy land close to the coast, but to much of the level red gum plains lying between the coast and the hills. The work will add materially to the cost of the land, but unfortunately much of it is of little use without.

3. With drainage, the natural corollary is irrigation. It sounds contradictory, but it is a fact; and I have taken note of large areas which, if drained, could be cheaply irrigated in summer, and be made to produce besides, a winter crop of ensilage, good summer crops of green fodder, roots and kale. I have been fortunate in seeing the country at its dryest time, and have therefore been able to note the quantity of water available for irrigation. In addition to the surface supply, there is the inexhaustible artesian supply yet undeveloped.

I should here say that I am aware that where the soil is of a deep, sandy nature, there will be some difficulty in applying the water over the surface. I cannot go into this now, and only wish to remove criticism by saying that I have not over-looked the matter. It should also be stated that irrigation in such a district as that under consideration, where the soil is always moist, is quite a different matter to irrigation in dry country, such as, for example, the Murray Valley in South Australia and Northern Victoria. Our experience in districts with a 30 to 35 inch rainfall, is that if the natural moisture in the subsoil can be supplemented in summer by a comparatively small quantity of irrigation, the results are wonderful. Local conditions always govern methods, and all I can do is to indicate the general principles and suggest general experimental work.

4. *The determination of the best fodder crops to grow.*—If my observations are correct, I am led to the belief that it is too much

to expect English grasses to provide green fodder in summer, except on picked, moist patches. That the grasses will live, I do not dispute, and that when the rains come, they will quickly give good pasture; but the rains do not come in summer, and it is too much to expect shallow rooted grasses to produce green fodder during five months of dry weather. When it is remembered that in Britain and in Eastern America gentle summer rains fall at frequent intervals, and that a month without rain is looked upon as a matter for comment and record, it is surely too much to expect the grasses which are suitable to such conditions, to give similar results in this State.

A word should here be said about lucerne, because during my visits round the country, I was more frequently asked about this plant, which, by the way, is not a grass, than about any other. I inspected several small plots, noted odd plants growing here and there, and was much interested in examining a paddock of some 12 or 15 acres belonging to Mr. Duce at Boyanup. A good deal of misconception prevails about this most valuable plant. It is essentially a summer crop, and except under irrigation, or under very exceptional conditions, such as exist at Bacchus Marsh, Victoria, it will not give big returns under such conditions as are natural to this State. Even where the roots can get down to moist conditions, it only makes short growth after the first early summer growth, except under intense culture and irrigation. To obtain a succession of cuttings, irrigation is necessary. At the same time, I believe there are great possibilities for lucerne in the South-West, and no plant offers greater scope for experiment on an extensive scale. It lives through the summer all right, and affords a bite of green feed all the time. I would like to see some of the sand plains tried for this crop, but I foresee a difficulty in keeping down the young growth of broom bush, wattle, etc.

In view of this fact, I am inclined to think that the fodder of the future on the West Australian summer pastures will not be a grass. What it will be I cannot say, but it will need to be a plant or plants which will have the power to feed on the subsoil, as do vines and fruit trees, and such native plants as the broom bush, stink bush, and wattle. One most noticeable fact in connection with the cultivation of fruit trees and vines is the remarkable growth they make when freely cultivated, and no one can fail to observe how the young wattles grow on cleared land after being broken up.

This fact affords one suggestion for the utilisation of land which will not grow summer grass, and cannot be irrigated. There must surely be some fodder plants which will grow as well, and produce succulent fodder. The value of one such a plant would be so great that it would be worth searching the world for it. It is in such work that I think much of the value of a Department of Agriculture lies, rather than in repetition of experiments in wheat-growing for example, which practical farmers can do far better at a fraction of the cost.

In connection with the growth of summer fodder, not only in the South-Western, but in other districts as well, one should not overlook the fact that in no part of Australia do all kinds of melons and squashes grow more freely than in this State. I have seen patches of pie melons and pumpkins, which would yield at the rate of 50 tons to the acre. The feeding value is not very high, but these crops afford a most valuable addition to the fodder ration at the latter end of summer, and may be kept stored for months. Where dry food has to be fed, no better corrective can be used.

The question of labour is, I am aware, a serious one; but the problem in Western Australia differs from that in the Eastern States only in degree, and will adjust itself here as elsewhere. It is not in my province to comment on the matter, and I only mention it because I am aware that some think the labour question is different here to the Eastern States, whereas the only difference is one of degree.

Ensilage Pits.

The details of making ensilage pits is not in the province of this report; but I feel that I should not be doing right in neglecting the subject altogether. When silos were first introduced in South Australia, they were expensive affairs both to construct and to work. My brother and I, however, made our first ensilage in a pit dug out of the stiff yellow clay on a hill side, and after just 20 years' experience with concrete and brick pits and stack ensilage, I can safely say that I have never seen better, although, of course, there was considerable waste. Since then, a great development has taken place in the construction of silos in America, and the underground silo and the silage stack have almost, if not altogether, been supplanted by the above ground silo, which in America is usually constructed of lumber, which of course is very cheap in that country. The Victorian Department of Agriculture two years since constructed a full-size model of an American stave silo on the grounds of the Royal Agricultural Society, and since then a number of farmers have constructed silos after the same model of stringybark timber. Here in Western Australia the best of woods, jarrah or karri, is plentiful and cheap, and I think that the Government could hardly do better than have one or more specimens built on proper but economical lines as an object lesson to farmers. It would not be a heavy expenditure to have one made at the Royal Agricultural Society's Show Ground as an example, and then offer to construct, say, one each for the first five farmers in five districts who would guarantee to use them for five consecutive years, and would pay the cost of material and allow farmers in the neighbourhood to inspect them and the ensilage made each year.

In the South-Western hilly country the conditions must again modify practice. Without going into details, I would say that I think that there is much suitable dairy country; but that while fat stock are profitable and labour high, it is not likely to be used for the purpose to any extent. In the natural course of things it will come in time.

SOME PROBLEMS AND SUGGESTIONS.

(1.) Dairying in the Eastern Districts.

The Past.—While wheat realised high prices and hay was worth £5 to £7 a ton, it might have been interesting, but I consider it would have been folly, from a business point of view, for West Australian farmers, especially with the high price of labour, to have meandered round attempting to run dairies to produce butter in competition with the excellent Victorian butter, which can, and is, sold at a profit on the London market at 100s. per cwt. Setting aside sentiment, the argument from a business point of view was equally strong with respect to production of milk for the goldfields. I hold that not one word reflecting on the enterprise, the business foresight, or the commonsense of the people of Northam, York, Newcastle, or other Eastern Districts can be said by any fair minded person seized with the whole facts of the case because a dairying industry has not been developed here:—but, "the old order changeth, giving place to the new."

The old order is changing now; but just how rapidly, how profitably, how thoroughly, it will change, will depend to a considerable extent on the assistance the Government will give. The time is ripe, many of the people are ready. This matter with its related subjects of summer fodder and marketing the produce at the Goldfields was the live question at Northam, York, and Beverley. At Northam the people said, "We see we have reached the limit of hay growing for high prices, and wheat is 3s. a bushel, we must see if we cannot develop dairying. Do you think it can be carried on profitably in our dry summer? Will lucerne grow here? Do you think we can grow mangolds? What fodders do you recommend? Which are the best cows to keep? How would you feed? Can we send milk to the Goldfields?"

Not once but many times these questions were asked, showing most clearly that the people are alive and waiting. The whole question is summed up in the remark of a prominent resident of Northam when he said: "We want help, we want direction, and we want it to-morrow morning."

In addressing the representative company who were kind enough to tender me a welcome luncheon, I endeavoured to answer in part at least some of the questions asked, and may be it will be well to repeat the substance of my replies here.

Can dairying be carried on successfully in Northam and kindred districts considering that there are practically six months without rain and green feed?

Decidedly yes. Not, of course, with the same simplicity as in the Western District of Victoria, but while there are special drawbacks there are special advantages. In the first place while the summer dries up the feed, the winter and spring are genial, and grass plentiful. In the second place, up to a certain and considerable limit there is a special and exceptionally profitable market.

As a practical instance always carries conviction much more forcibly than mere statement, I have at various times taken as an example the family cow at home. She has only a small paddock of 1½ acres, and is fed through the summer months almost entirely on chaff and hay, and bran, to which diet is added about 1lb. of copra cake in winter and a small bundle of lucerne in summer. She remains in milk up to a few weeks before calving, and gave from 7,500 to 8,000lbs. of milk a year for three years in succession. The town dairy cows are fed chiefly and often almost entirely on chaff and bran. So far, therefore, it is merely a business proposition as to whether it will pay better to sell hay or turn it into milk and butter.

But that is only part of the solution. I am informed, and one may see evidences all around of the fact, that green fodder is very plentiful in the spring. By sowing mixed crops of oats, barley, peas, and tares, tremendously heavy crops of green stuff can be grown, and this can be made into ensilage at a comparatively low cost. Roughly speaking, a cubic foot of good silage weighs 50lbs., and this, with a little straw pickings in the paddocks and so forth, will be found ample to keep up the supply of milk through the summer.

I understand that the Cape weed grows very luxuriantly in the Eastern Districts, and produces an enormous amount of succulent green stuff. This will not make good silage alone, being too watery, but herein lies one of its virtues for usefulness in the district where there is also an unlimited supply of cockie chaff and good, sweet oaten or wheat straw. If the chaff and straw be stored in the summer, and kept until spring, it can then be mixed in about equal proportions with the cape weed and other green stuff and a sprinkling of salt in silage pits, and the result will be a nutritive, palatable ensilage which the cattle will relish, and which will produce good milk all through the summer.

My present opinion is that in ensilage, rather than summer crops, lies the chief solution of one phase of the dairy question in the Eastern Districts. Not only does it provide for the utilisation of valuable food which now goes to waste, but the feeding value of good ensilage is very much greater for dairy cattle than that of good hay. This does not apply to working animals. It must also be remembered that the better the material used in making ensilage, the more nutritive the product of the silage pit. One could not expect the same results from the mixture of Cape weed and cockie chaff as from a well-grown silage crop of oats, barley, and peas, or oats, barley, and tares. At the same time, it is also true that the results obtained from feeding ensilage made from a given material, as against the same material made into hay, is largely, if not chiefly, due to the physical condition of the food, the digestive coefficient being higher for ensilage than for hay; but this is too large and too technical a subject to be dealt with here.

What are the prospects of lucerne growing? In reply to this question, and it has been a frequent one, I have often said:—He is

a wise man who restricts his opinions to things he knows. But if carried to extremes such a man's wisdom will die with him, and the sooner the better, for he will be of little use to anyone, for he who never ventures an opinion misses all the opportunity of having it disputed, and subsequently either established or corrected. I have formed opinions, and talked over them with such farmers and others as opportunity offered, and while I wish to be very guarded in making positive statements, I wish to be as perfectly candid in making suggestions; but perhaps the subject can be best treated by grouping the summer-growing fodders such as lucerne, mangolds, maize, sorghum, and so forth under the general question—What are the prospects for growing summer fodder in the Eastern Districts?

First of all we must consider the conditions; and in proportion as one grasps these, he may be considered to be in a position to form conclusions.

The essential conditions I consider to be, first, the rainfall of the district, which, I understand, is from 19 to 21 inches. In considering this item of rainfall we have to make a comparison, which was new to me when I came here. When we in the Eastern States speak of a rainfall of 19 inches, we understand that to mean about 14 or 15 inches during the winter season or growing months, and four or five inches on an average during the summer months; and I understand from old residents—and the opinion is confirmed by the Government Meteorologist—that there are practically no rains at all during the five, and sometimes six, months of the summer. This means that the whole of the rain practically falls during the time when it is required for the growth of crops. This fact is not understood outside Western Australia, but is one which cannot be too forcibly emphasised, because it makes the whole difference between success and failure in growing cereals under some of the conditions of the Eastern agricultural areas. It is also not less important in connection with the consideration of the utilisation of the country for dairying purposes. With four or five inches of rain falling during the summer months in occasional thunderstorms, catch crops can be grown, which would provide summer fodder for dairy stock; but such is not the case in the Eastern agricultural areas.

We have, then, to consider how can dairying be carried on during a period of five or six months without rain, and it seems to me too much to expect any kind of grass to produce green fodder under such conditions. There are grasses which will withstand the long period of dry weather, and come up fresh with the first rains falling; but it is not that which is needed, but green food during the actual dry months; so that the problem is really quite different to that experienced under Eastern conditions. While we cannot expect grasses to grow, we find on every hand that vines and fruit trees will make a vigorous growth during the summer, and produce large quantities of green foliage. Now, if fruit trees will grow and produce a large quantity of green leaves, is there not some plant

which can be found which will produce a succulent fodder suitable for dairy stock during the dry summer period. The problem is one of great importance, and even if the world has to be searched for such a plant, I think that a successful result, or I should say that the chances of a successful result, would fully warrant any outlay necessary for the search.

Another question which arises is the practicability of irrigation in the Eastern Districts. On this point I am not sanguine for the present, because, if I am seized of all the facts, I find that any water that may be available in large quantities has a tendency to be saline. In considering such problems as this, it does not do to be over-sanguine; we must face all the facts, and I think that these points which I have mentioned will materially modify any opinions which might otherwise be formed as to the practicability of irrigation. In going round the farms, however, I notice that in very many cases indeed there are patches, varying in area from half an acre upwards, where the soil, although somewhat saline, is moist all through the summer; and these patches, I think, should be tried with crops of mangolds and salt bush. Lucerne will do, but I doubt if there will be a sufficient amount available for cutting during the summer months. However, experience alone can test this. I have seen a few patches, and these point to the plant thriving well enough under the conditions; but the question is—How much fodder can be got from a given area of land? Another point in connection with irrigation is the difficulty of applying water on sloping or uneven land, because it is a recognised thing that for complete success in irrigation work the soil should be properly graded. From these considerations I think that, for the present, the idea of irrigation on anything but a small scale may be set aside.

In conjunction with the fodder question, I think it extremely desirable that extensive experiments should be made for testing the suitability of salt bushes. The experience of California indicates that several of our native salt bushes, if cultivated on such moist situations as are frequently to be found in the Eastern Districts, will produce a large amount of succulent fodder, which may be cut in the same way as lucerne, and I would respectfully recommend that this is a suitable subject for careful experiment on a somewhat extensive scale by the Department of Agriculture.

However much I consider the position, I am forced back to the conclusion that the district, being essentially a winter rain country, ensilage will be the standing solution, for the present at all events, of the summer fodder question for dairy cattle.

We have now to consider the utilisation of dairy produce, if produced, and in this connection we have two facts equally prominent: the one is that the Eastern farmer desires to go into dairying for money-making purposes; with him it is to be simply an industrial proposition; but equally prominent is the fact that the goldfields want fresh milk and cream, and fresh butter, not only for

food, but for the influence it will have upon the health of the people, especially of children. It is not only, therefore, an industrial question, but one of hygienic importance to Coolgardie, Kalgoorlie, Boulder, and other centres. I am of opinion that it is thoroughly practicable to economically produce a plentiful supply of good milk, and by a system of sterilising, and the providing of refrigerating cars to carry it to the fields, and refrigerating stores on the fields, to place it before the population of these centres in a perfectly fresh and unadulterated condition. In theory, the problem is simple and, I think, in practice will not be found at all difficult. At the same time, one must not shut his eyes to the fact that great care will have to be exercisd in the various details.

With the development of the dairying industry, and with the supply of cheap wheat, which is unsuitable for milling purposes, will come the development of the poultry industry in all its branches; and in this I believe there are great possibilities for the Eastern districts, because, as far as one can see, the conditions are as thoroughly favourable as they are in any part of Australia.

Sheep on the Farm.

Where dairying cannot be carried on under fairly favourable conditions, I am of the opinion that the stock which will be found most profitable on the Eastern farms is sheep; and here we have the experience of South Australia to guide us, for during the last ten years there has been an immense development in connection with the keeping of sheep on farms, which has been largely due to the growth of the frozen lamb trade. If my memory serve me, during the past season Adelaide shipped, approximately, 160,000 lambs for the London market. The bulk of these was bought either on the farms or in the sheep market at very profitable prices, and there is every indication of the trade growing from year to year. Now, the Eastern Districts in this State are as well situated for the development of this trade as either Victoria or South Australia. The lambs are required for shipment at the time when there is abundant grass available, so that the farmer will simply have to keep a proper number of breeding ewes, and provide proper feed in the dry season for the maintenance of these in a healthy condition. For this the value of the stubble cannot be over-estimated, and he will have an ample supply of suitable feed for the rearing of lambs during the spring and early summer. I look forward to the time when this industry will assume very large proportions—indeed, all the way from Newcastle down to Katanning and Broome Hill.

DISEASES OF STORED FRUIT.

By H. M. Nicholls.

The fungoid diseases that affect stored fruit are a matter of serious interest to nearly all fruitgrowers. Though apples may be perfectly sound when stacked away in winter, it is by no means an uncommon experience to find them seriously damaged when packing takes place. In many cases half the apples are worthless, and I have heard of cases where 90 per cent. of them have been lost. Everyone who keeps fruit back for late markets suffers more or less, and therefore I think our own experiences in dealing with stored apples may be of interest.

There are many fungi that attack fruit under these circumstances, no less than five different kinds being found on our own apples, but only two of them were of any practical importance, the remainder being varieties that did not cause any appreciable loss. I do not propose, in this short article, to go into any of the recondite peculiarities of the microscopic fungus tribe, but rather to deal with them as they present themselves to the eye of the disgusted fruitgrower, when he uncovers his cases as spring approaches. If French Crabs have been kept late, the chances are that many of them will be found covered with a blue mould, upon which dewlike drops of water appear, and the apple itself is quite rotten and watery. This is the *Penicillium glaucum*, one of the commonest of all the minute fungi. Its spores are practically ubiquitous, being found in the air, in the water, and on the ground. So common is it that it has to be specially guarded against in bacterial cultivations. It may be easily recognised under a low power of the microscope, the greenish-blue conidia being born in chains, like strings of beads, on the fruit hypha. Fortunately it does not attack all apples alike, being more partial to Crabs than any others, at least so far as our experience goes. It causes great loss to orange growers on the mainland, and I have lately read of this or an allied fungus (*Penicillium digitatum*) as doing terrible damage to stored oranges in California. It first occurs as a minute white patch, generally around the eye of the apple, but it may make its first appearance anywhere on the fruit, and as it develops, the colour gradually changes to a bluish green. It spreads rapidly, and once it is seen the fruit should be gone over as quickly as possible, or the chances are that it will all be affected. Fumigation has very little effect upon it.

Perhaps an even more serious disease is the second one of the two I have alluded to. This is the Bitter Rot (*Gloeosporium versicolor*), which is much commoner than is generally supposed, and is probably responsible for nearly all the decay that occurs in stored Scarlets and Sturmers. It affects all fruit more or less, but the Sturmer is particularly liable to its attacks. The Scarlet,

probably through not being kept so late, does not appear to suffer so much. The disease first appears as a minute brown speck, which spreads in concentric rings of different shades of brown, until a large portion of the apple is affected. The different shades of the rings give the disease a very peculiar appearance, and render it easily recognisable in its earlier stages. As it progresses, small pustules appear upon the decayed surface, generally first in the centre, and these in a few days burst, disclosing a quantity of minute salmon-coloured spores. The rings keep extending until the whole apple is rotten. The disease is very rapid in its progress; apples that are quite sound one week may be found half rotten the next. In our own case, a number of Sturmers were stored away, and carefully inspected at intervals of about a week. The last inspection showed that within a few days the disease had appeared and spread with such rapidity that nearly half the apples were worthless, though they were quite sound the week before. I have heard of many cases last winter of Sturmers rotting when stored, and in most of the cases it seems to have been due to this disease. It sometimes affects apples upon the trees, but this is not common in my experience.

When apples are attacked by these two fungi, little can be done by way of cure. The only remedy is to pick over the cases and throw out and destroy the bad ones. Both of them, however, can be very easily prevented by summer spraying with weak solutions of Bordeaux mixture. The Bitter Rot, especially, is very easily kept in check by this means. The Sturmers I have alluded to were not summer-sprayed, but some other Sturmers, stored alongside them, which had been summer-sprayed, were quite unaffected, and opened up quite free from either Bitter Rot or mould. This has been our experience for some years. I have heard that fruit-buyers sometimes object to taking fruit that has Bordeaux mixture upon it, but if they only knew it, it is the best of all guarantees that it will keep.—In *Agricultural Gazette*, Tasmania.

THE LUCERNE TREE.

(*Medicago arborea*, Linn.)

In the *Bulletin de la Societe Nationale d' Agriculture*, M. Andre refers to a plant which he strongly recommends for forage purposes in hot and dry climates, and in places where the soil is poor and stony. This is the lucerne tree (*Medicago arborea*) a rather low-growing shrub, which bears an attractive yellow flower, and must not be confounded with the so-called Tree Lucerne or Tagasaste (*Cytisus proliferus*) seeds of which were distributed in New South Wales by the Department of Agriculture several years ago, and

with which many readers of the *Gazette* are no doubt quite familiar. The true lucerne is to some extent regarded more as an ornamental than a commercially valuable plant in France; but M. Andre finds that on the Mediterranean littoral its feeding value is fully recognised, and it is extensively grown.

Chemical analysis of the lucerne tree gave the following results:—

	Per cent.
Nitrogenous matter	13·12
Fatty matter...	0·99
Non-nitrogenous matter	42·47
Cellulose	23·00
Minerals	5·42
Moisture	15·00
	100·00

Thus it will be seen that although there is a rather high percentage of woody indigestible matter, the feeding value is great, and it is notably richer in nitrogenous matter than meadow hay, and is even superior in this respect to the best lucerne. Experiments have shown that it may be used successfully as food for all kinds of farm animals to their advantage. From a nutritive point of view, it is a fodder of the first order, and leaves nothing to be desired from an alimentary and hygienic point of view.

"It must not be forgotten," says M. Andre, "that this shrub is specially fitted to produce rich forage on very poor land." In rich soil, on cultivated land, the growth is much inferior, but on stony ground, with plenty of sunshine, it grows well, if certain precautions are taken. On the embankments of railway cuttings, for instance, lines may be traced 40 inches apart, and holes made with a pickaxe 16 to 20 inches wide and about the same depth. These are filled with good soil. It would be better still to make a continuous trench partly filled with good soil, so that the roots can intertwine. If the slope is steep, the soil taken out of the trenches should be heaped up below the trench, so as to form a sort of bank which will dam up the rain water to the benefit of the plant. When the ground is very stoney it is best to put a little good vegetable soil around the roots. If once the roots take hold, the plants will take care of themselves.

The soil should be prepared in winter, and the planting done in spring. The winter rains will have refreshed the soil, and the spring sun will set the plants growing with rapidity. In stony ground, which has a sufficient quantity of soil, or where there are fissures between the rocks into which the roots can penetrate deeply, the plants may be placed 40 inches apart which will give about 4,000 plants to the acre. Of course in poor soils they must be put farther apart.

Propagation by seed is perhaps the best way to cultivate this shrub, but the seeds are difficult to obtain in large quantities.

The *Medicago arborea* grows well on the chalky soil of the South, particularly in the neighbourhood of Nice and Monaco, but it also thrives on rocky ground.

As soon as the plantation is well established, as regards products of forage, the leafy branches should be cut in spring, immediately after the full development of the foliage, and given to the cattle which eat even the wood if it is still soft. Fresh branches will then shoot and produce a second crop.—*Agricultural Gazette of N.S.W.*

REGULATIONS ON IMPORTATION OF HORSES.

Department of Agriculture,
Perth, 30th March, 1904.

His Excellency the Governor in Council has been pleased to make the following additional Regulations under "The Stock Diseases Act, 1895."

JOHN M. HOPKINS,
Minister for Lands.

Regulations.

The following Regulations are incorporated with the Regulations made on the 24th day of September, 1902, and published in the *Government Gazette* on the 26th day of September, 1902:—

1. All horses imported into Western Australia from beyond the limits of the Australian States and New Zealand shall, immediately before leaving the place of shipment, be subjected by a duly qualified veterinary surgeon to the Mallien test for glanders, and a certificate of the veterinary surgeon that they have been submitted to such test and are free from disease or infection must be produced before the landing of such horses will be permitted.

2. All such horses may be again subjected to the Mallien test after their arrival and before they are released from quarantine if, in the opinion of the Chief Inspector of Stock, such test is necessary.

3. All cattle imported into Western Australia from beyond the limits of the Australian States and New Zealand shall, immediately before leaving the place of shipment, be subjected by a duly qualified veterinary surgeon to the tuberculin test for tuberculosis, and a certificate of the veterinary surgeon that they have been submitted to that test and are free from disease or infection must be produced before the landing of such cattle will be permitted.

4. All such cattle must be again submitted to the tuberculin test after their arrival and before they are released from quarantine if, in the opinion of the Chief Inspector of Stock, such test is necessary.

CAMPAIGN AGAINST THE CODLIN MOTH IN CALIFORNIA.

The following review of the work of investigation initiated under the auspices of the University of California on the methods of checking the ravages of the codling moth will prove interesting. When the fuller report reaches us, we will summarise it for the benefit of the readers of the *Journal*. To Mr. Pritchard, of Kalgoorlie, we are indebted for the progress report taken from the California press :—

"Berkeley, December 2.—After eight months spent unremittingly in the campaign against the codling moth in the upper orchards of the Pajaro valley, the University of California agricultural experts have just returned to Berkeley, having finished their labours for this year. The costly insect pest has not been eradicated; nobody expected this; but the secret of checking its ravages has been learned, and, although much has yet to be done before the work can be said to have been finished, nevertheless the orchardists have been saved over $100,000, and have been taught a scientific way to fight the tenacious little worm. The codling moth will never after this be the dreaded foe that it has been for years in California's richest apple-growing region.

"Professor C. W. Woodworth, with Warren T. Clarke and William H. Volck, of the entomological department, and J. S. Hunter, entomologist, working with the ornithological survey, have all spent much of their time in the afflicted country, working in co-operation with the Watsonville farmers. They will spend the winter months in going over their notes, and preparing bulletins on the big insect campaign, and also laying plans for the next season's work, for the agricultural department is determined to prosecute the investigations until everything possible has been attempted to reduce the damage done by the codlin moth. In this resolution they are heartily supported by the farmers in the Pajaro Valley, who are willing to pay generously for a continuation of these insect studies. The recent campaign has cost the counties of Santa Cruz and Monterey a total of $2,925, but, in view of the immediate returns for the money spent, no one regards the small appropriation as comparable with the thousands of dollars that have been saved."

"Last season the wormy apples lost $500,000 to the Watsonville orchardists, and this represented 40 per cent. of the entire crop. By the efforts of the University entomological experts, this loss has been cut down to only 5 per cent. That the secret of successful spraying has been discovered can hardly be doubted. As this year was largely experimental, and as not all the orchards

entered into the work, next year's results are expected to be a better criterion of what the agricultural department has done in the way of solving the big insect problem."

"The greatest point now to be settled is that of keeping the trees and fruit uninjured by the strong arsenical sprays that are applied to kill the moths. In a few orchards the insect poisons with which the apple trees were drenched affected the leaves, making them wither and drop off, and it also had an appreciable effect on the apples, making them undersized. This difficulty can be overcome, it is believed, by coating the compounds with an extra spray of linseed oil. Another important point to be determined, and one that must remain until next year, is the actual extermination of the codlin moth. The results of this year's spraying show only in the comparatively clean fruit, and the loss of numbers among the insects can be determined only approximately."

"A side investigation of immense practical interest has been carried on during the period of the spraying experiments by Professor F. E. L. Beale, the United States Government economic ornithologist. With him has been associated J. S. Hunter, undergraduate assistant in the entomological department. The task of these two men has been to shoot and dissect some 1,300 birds found in the apple orchards. A microscopic examination of the stomachs of these birds, it was believed, would reveal vital facts concerning their value or harm to the fruit industry. While only about 15 per cent. of these bird stomachs have been studied, some interesting information is already available. Hunter says that none of the birds found in the orchards are as injurious as they have been commonly supposed to be. Instead of being pests, they are benefactors, and ought to be protected much more strongly than they are, especially at nesting time. The depredations that these birds make on the fruit are small compared with the great good they do in eating the codlin moths, especially the pupæ and larvæ and cutworms and other harmful insects. The black-headed grosbeak, long supposed to be an orchard enemy, has been proved to be a great foe to the codlin moth. Out of 24 specimens there was found in the stomach contents an average of 90 per cent. of injurious insects, and 14 per cent. of these were the codlin moths. Other valuable insect destroyers were the yellowhammer, woodpecker, the Arizona chipping sparrow, and the linnet, this last bird feeding more particularly on the woolly aphis."

CHICKEN POX.

A Contagious Disease of Warm Climates.

Petaluma *Poultry Journal*:—Through the courtesy of Foreman H. O. Woodworth, of the Petaluma poultry experiment station, the latest bulletin of the Florida experiment station on the subject of *Epithelioma Contagiosum* is here reprinted. This is the time of the year when attacks of this disease may be expected if at all, and Mr. Woodworth requests that any cases which may occur be reported to him or to Dr. Ward, so that they may make a study of them. This bulletin was written by Charles F. Dawson, M.D., D.V.S.:

In all warm countries there prevails a poultry disease which attacks fowls, turkeys, pigeons, and geese, the younger animals being most susceptible. The disease is quite common in the Gulf States, and is somewhat of a scourge in Florida. It is characterised by the appearance of wart-like bodies, which form upon the head, eyelids, neck, beak, and nostrils, where they attain their largest size. These warts or tumors may spread to the comb, wattles, feet, and wings, the latter being particularly the case in pigeons. After one or two weeks development the warts burst and discharge a fluid which is at first watery, but which later becomes viscid, yellow, and malodorous. In mild cases where the disease remains local the warts dry up, form crusts which fall off, and the case ends in spontaneous recovery. This is the exception, however, the rule being that the bird dies of exhaustion, especially in those cases where the disease invades the mouth and nostrils.

It being a contagious disease, the introduction of a single case is sufficient to infect the whole premises. An infected fowl roosting beside another may cause the disease in the latter by simple contact. Poultrymen state that the disease results from the bites of insects. This is likely true to a certain extent; but we go a step further and claim that fleas, mosquitoes, ticks, lice, or flies may be the agency through which the disease germ is inoculated into the fowls, as is the case of the dissemination of yellow fever, malaria, Texas fever, anthrax, and probably other diseases of man and animals.

"Sore head" or "warts" is caused by a parasitic fungus belonging to the group known under the name Blastomycetes. The most favourable conditions for an outbreak of this disease are overcrowded poultry-houses in which excrement is allowed to accumulate, dampness caused by leaky roofs, bad drainage and wet seasons; it being most common in poultry hatched late. Hence, an important phase in its prevention is cleanliness and perfection in the poultry-house. Excrement should be removed frequently and the floor sprinkled with lime. Leaky roofs should be repaired. Frequent purification of the interior by whitewashing is advisable. Old

nests should be removed and burned. The shelves and feeding troughs also should be regarded with suspicion, and drenched with scalding-hot water. The affected fowls should no longer stay with the well ones, but should be confined, fed well, and treated medicinally.

Treatment consists in the use of germicidal ointments or solutions applied directly to the warts. There is a long list of such agents to choose from, and any one of the following should be effective: Carbolic salve, glycerite or carbolic acid, sulphate of copper in 2 per cent. solution, spirits of turpentine, tincture of iodine applied with a camel's hair brush so as not to get the iodine into the eyes or nostrils. Creolin may also be used. In employing this remedy it is necessary to slice off the end of the wart and touch it with a drop of the remedy daily for several days. Mr. Jeffries, of the Horticultural Department, claims to have used the petroleum product, axle grease, with good results in mild cases.

FRUIT-GROWING AROUND PARRAMATTA.

The following article on the state of the fruit-market in New South Wales is taken from the *Town and Country Journal*:—

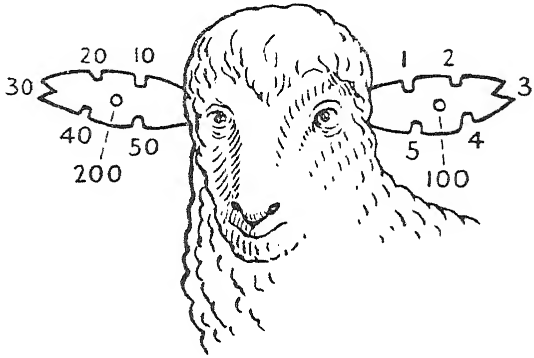
"What with glutted markets, low prices, and destructive pests in the orchards, the lot of fruit-growers around Parramatta has been cast in anything but pleasant places for some time past. The season, intense in its propitiousness, has been productive of one of the most prolific crops of fruit ever harvested in those portions of the county of Cumberland. Yet in the midst of all the plenty that exists, the industry is at a very low ebb, and just now most of those engaged in it are unable to balance their pains with their pleasures. The market is overdone to such a degree that even the most fortunate growers are getting very little for their fruit, whilst in some instances—all too many unfortunately—the returns have scarcely compensated for the cost of the cases in which the fruit was packed. At the weekly auction sales at Parramatta last week, peaches of very fair quality were sold at 6d. per half-case. Good quinces went for 9d. for the same sized case, and much fruit of moderate quality, including peaches, apples, and quinces, realised only 3d. per half-case. Choice grapes were 'knocked down' for 1¼d. per lb. for 26lb. boxes, and the best price obtained for good apples (half-case) was 1s. 3d. As one man said, during the progress of the sales, 'Evidently fruit-growing is a better thing for the man who isn't engaged in it than for the man who is.' However, with such absurd prices ruling, it

is not to be wondered at that growers are disheartened and dissatisfied with their lot. For years they lamented the fact that the bad seasons were the cause of their troubles, but this theory has been ruthlessly exploded by the favourable conditions which have prevailed during the last 12 months. The fact has been made obvious enough, in all conscience, that it will not pay to keep orchards merely to supply the raw fruit, especially in times of good seasons; for then, when the crop is abundant, instead of enriching the growers, it overruns the market, and invariably occasions loss. The problem is then to find a means for utilising the surplus fruit in some remunerative way; and this is what many of the Parramatta fruit-growers are now endeavouring to solve; but whether any good will come of their efforts remains, of course, to be seen. For some reason or other the growers there do not pull well together. In the course of conversation with several the other day, the writer learned that various movements have from time to time been set on foot with a view to benefiting the condition of those engaged in the industry, but they have all gone 'to the wall' because of lack of support. The glut of this season, though, has given every fruit-grower such a blow that it is hoped the indifference which has in the past been characteristic of the general attitude towards movements inaugurated for their benefit will not be manifest in the future. Some men are in favour of the establishment of jam and fruit-preserving factories for dealing with the surplus fruit, while others regard cold storage more favourably. A combination of these two systems, conducted by a strong co-operative organisation, should tend to remove much of the disabilities under which growers now labour. About 12 months ago efforts were commenced to float a local company for the purpose of jam-making, pulping, storing, and preserving fruit, in order to deal with surplus supplies and relieve the glutted markets. Sufficient shares having been subscribed, the company was registered a couple of weeks ago. Messrs. R. Ray (Castle Hill), W. Thompson (Marsfield), E. J. Aitken (Sydney), and G. Henderson are the directors. The company has acquired the leasehold premises, plant, good will, and effects of the Parramatta Refrigerating and Ice Company, and intend to have everything in readiness to start operations at the commencement of the next fruit season. The aim of the promoters is to distribute the profits in such a way as to induce all fruitgrowers to do their business through the company, which proposes to regulate the sale and export of fruit, so that high prices may be realised, and expenses lessened. Although some difficulty was experienced in floating the company through want of interest on the part of growers, it is to be hoped, for the betterment of the industry, that it will succeed in serving its purpose."

[Whilst sympathising with them in the East, it would be as well to lay the above to heart. It may be some time yet before we are placed in such a condition here, as not only has our supply to be considerably augmented, but we have the additional advantage of being so much nearer foreign markets than growers in any of the other States.—Ed. *Journal.*]

EAR-MARKING FOR STOCK.

The system of ear-marking sheep and cattle shown in our sketch (from *Hoard's Dairyman*) is extremely simple, and by its means the stock-owner will have a ready means of identifying every



animal in his stud. It is best to commence with No. 1 in both sexes. When the figure required is above 5 two cuts are made, thus for 8 the cuts 5 and 3 are employed, and the same on the other ear for numbers over 50.

AUSTRALIA AS A FOOD-PRODUCING COUNTRY.

Paper read at a meeting of the Royal Colonial Institute, London, 12th January, 1904, by Charles C. Lance, Commercial Agent in London for the Government of New South Wales.

The great interest which has recently been awakened in the subject of the food-producing capabilities of the Empire seems to justify the contribution of a paper on the resources of Australia in this direction, more especially as considerable misapprehension appears to exist in certain directions in regard to it.

The harrowing tales of loss and suffering through the long-continued drought (now happily ended) have created an exaggerated impression upon the public mind of this country, and the idea often prevails that every portion of Australia has been held so firmly in the grip of this dread monster as to seriously impair

the claim of the Commonwealth to be regarded as a reliable source of food supplies.

I have no desire to make light of the effect of that calamitous visitation, but wish to present it in its proper proportion, in order that a fairer estimate may be formed in this regard, before proceeding to lay before you a statement of the achievements and potentialities of this vast region.

The two points that require to be emphasised are—

(1.) The drought has been unprecedented in the history of the white population of Australia.

(2.) The harrowing statements in regard to it have referred chiefly to the region in the west of New South Wales and Queensland, and central portion of South Australia, where more or less dry conditions are expected to prevail, and where wool-growing is the chief industry.

The Southern and Eastern littoral of Australia have had comparatively dry times, equally unprecedented in many parts, but nothing in the nature of devastation has been experienced, and the production of exportable food surpluses has never entirely ceased.

I submit that the temporary arrest of agricultural production occurs, at more or less lengthy intervals, in well-nigh every country in the world, and drought is not the only factor. Those who have travelled through England this past autumn will know the tale of ruin so pathetically told by rotting and ungarnered crops and flooded lands. The choice between suffering from being too much in the sun, or too much under a cloud, is a matter of taste. There is this to be said in favour of a drought, that its lessons may be learnt, and its effect to some extent provided against, whilst the beneficial rest given to the land enchances its productiveness in the immediate future; and speaking of Australia generally, one thing that weighs heavily in its favour is the pregnant fact that it has no winter, as it is understood in this country, or in North America. This perhaps means nothing for the growing of wheat, but it means much in the raising of stock for meat purposes, and the production of butter—two very important items of export. Given sufficient moisture, grass will grow more or less at all times, and stock and dairy cattle may graze in the open all the year round, whilst in many districts two fodder crops are often raised.

The exportable food products of Australia are at present raised in South Australia, Victoria, New South Wales, Queensland, and Tasmania. Western Australia has no place in this category, but there are potential areas on the South-Western coast, which in course of time will, at least, supply many of the needs of the goldfields communities, and thus release for external export some of the products that find their way there from the Eastern States.

But in a huge continent like Australia, with an area of 2,972,906 square miles—26 times greater than that of Great Britain—and

covering 32 degrees of latitude and 40 of longitude—extending from Tasmania in 43 degrees South, with a climate not unlike that of England, to Northern Queensland in 11 South, with a climate similar to that of India—a great diversity of soil, climate, and production must of necessity be experienced.

Thus in Queensland we have principally meat, sugar, and a small but growing production of butter. In New South Wales, meat, wheat, butter, wine and sugar. In Victoria, butter, wheat, meat, wine, and fruit. In South Australia, wheat, meat, wine, fruit, and butter in a small but increasing quantity. In Tasmania, the only important item of food export is fruit of the European descriptions.

During the past four years (1903 being not yet available) the total exports of the items of meat, butter, wheat, and flour, fruit, and wine, were valued at—£5,566,000 in 1899; £6,610,000 in 1900; £7,594,000 in 1901; and £4,733,000 in 1902.

This latter year makes a more presentable figure than the jeremaids of critics would have led us to expect; nevertheless, it fell as far short of its predecessor as I hope it will also do of 1904, which is already testifying to the marvellous recuperative powers of the Island Continent.

As indicating the importance to Great Britain of this source of supply, it may be stated that the value of food imports into Great Britain from Australia were—during 1899, £5,079,988; 1900, £5,276,272; 1901, £5,492,313; 1902, £3,550,933.

It will be observed that although the total sent to Great Britain in 1901 was the largest recorded, it did not bear so great a proportion to our total exports as in previous years, which is accounted for, chiefly, by the market for our products that sprang up in South Africa.

Having disposed of these preliminary generalities, I now propose to deal with each principal Australian food industry, and to endeavour to show its present position, and the prospects of its extension in the light of the potentiality of the country itself, and of the probable competition from other sources for the export trade.

Meat.

Sir Edmund Barton once said, in reply to a Canadian claimant, that if Canada was the Empire's baker, Australia was the butcher; the figure was picturesque, but it would have been more correct to have used the term Australasia, for in this claim New Zealand cannot be left out of consideration. Nevertheless, the meat export from the Commonwealth has reached considerable dimensions, having been valued at £2,500,000 in 1901.

It is to the introduction of refrigeration that we owe this great development, and to Australia (and more particularly New South Wales) belongs the honour of having pioneered this boon for the world. The initial experiments were made in Sydney by Eugene

Nicolle and the late Hon. T. S. Mort, the latter giving his life and fortune to the enterprise. His prophetic motto was, "There shall be no more waste," the significance of which may be realised from the fact that, prior to the introduction of refrigeration, the boiling down of surplus sheep for tallow was, in many districts, regarded as the only profitable proceeding. If there were time, the romance of Pioneer Mort and Engineer Nicolle would be worth the telling. How, away back in the sixties, in the Blue Mountain village of Hartley, they experimented with machines for the production of cold by the compression of gases, for which English patents were obtained in 1873. How, in 1879, the first ship, the "Northam," was loaded with frozen meat, the insulation for which was tallow. How the machinery broke down, and the melting of the tallow deprived the meat of its necessary insulation. How others, profiting by these mistakes, achieved success, and in 1880 brought from Australia in the "Strathleven," and delivered in London in saleable condition, the first cargo of frozen meat. Such is the story of the original defeat of time and temperature in the carriage of fresh food products across the world; and it is also interesting to note that the first ton of artificial ice was made in Geelong, Victoria, by one Dr. Jas. Harrison. Thus, if Australia had done naught else in the world, she would deserve something at the hands of those who realise the value to the old world of the fresh products of the new.

The refrigeration of food is a growth of scarcely twenty years, and yet it has probably brought about the greatest revolution of modern times. Such revolutions come quietly, and those who are influenced the most by them often do not stop to contemplate their far-reaching effects, or focus the changes brought about. To many, the luxury of an ice-chest, or the questionable blessing of iced drinks, form the sum of their knowledge of the influence of refrigeration. The housekeeper, who can buy apples nearly all the year round in England, does not care to know that she does so by reason of the fact that, in California, millions of bushels of the crop, picked in September, are stored in cold chambers till the following February, and gradually fed to meet the requirements of this market: or that the refrigerated holds of the Australian mail steamers are full of this choice fruit from March to June. The fact that the English apple crop has failed is only known through the medium of newspaper paragraphs. The wealthy who eat peaches and apricots at Christmas, perhaps think that they do so by virtue of the hot-house, whereas in reality it is the cold-house that has smiled upon them, in the shape of the refrigerated holds of the South African mail steamers. The striving millions who can buy meat that was denied to them twenty years ago, aye, or even ten years ago, may be forgiven for not staying to realise to what they owe this boon. They may be pardoned for not knowing that the meat has been frozen—for, indeed, I fear that very often they are not told! The artisan who now finds fresh butter on his daily menu probably does not think that he owes it largely to refrigeration, which not only makes the production of butter possible in the hottest climates, but brings it in perfect condition across the melting

tracks of the Equator. But if the consumer can tell us this tale, the producer can treat us to a romance—a romance of the changing of the face of Nature; of hitherto unprofitable forests felled to create pasturage for sheep and cows, and of irrigation schemes, and smiling orchards, made feasible by the ability to transport the produce across the world. Without speaking of other countries, it is safe to say that refrigeration has provided the greatest modern stimulus to the development of Australia and New Zealand. Wanting it, "Australia as a food-producing country" would have been resolved into a question of what could be done in wheat-growing, or a statement as to its capacity to feed itself. Wanting refrigeration, Mr. Chamberlain's scheme for preferential trade would have been impossible, or at least shorn of its far-reaching significance. In a word, refrigeration has equalised climate and annihilated distance, has revolutionised modern life, and may yet be the most potent factor in the federation of the Empire!

It was in 1891 that Australia reached the high-water mark in the possession of sheep and cattle, in which year there were $106\frac{1}{2}$ million sheep, and over 11 million horned cattle. Successive years of drought have very seriously reduced these figures, and it is probable that they would not at the present time stand at much more than half that.

Such, however, are the marvellous recuperative powers of the country, that since the break of the drought it is estimated that the sheep in New South Wales alone have increased by four millions, and shipments of meat have been resumed upon a considerable scale.

Ever since the frozen meat industry has been firmly established in this country, the Australian flocks and herds have been under adverse conditions, and a return to the normal will bring about a striking development in it. A better knowledge of the requirements of this trade as regards breed and quality, preparation and distribution upon the markets, increased transport facilities in Australia and from Australia, are all potent factors which have not yet had the opportunity of full play in the Australian trade.

And then, of course, instantly arises the question, what will be the effect upon the market? Can larger supplies be absorbed at a price that will be profitable to the producers? It is to Great Britain that we must look for the chief market, and indeed it is very largely the object of this paper to show the position of Australia as a food producer in relation to the Empire. The market that exists in South Africa cannot be regarded as permanently large, and a return to normal conditions in that war-swept country will bring about a great measure of self-sufficiency in the matter of meat. The high duties and restrictive regulations which exist on the Continent of Europe practically place those markets beyond immediate consideration.

The British Isles stand already at the top of the list of meat consumption per head of population in Europe; Australasia itself, and the United States being the only greater in the world.

The approximate figures are —

Great Britain, 115lb. per inhabitant per annum; United States, 150lbs.; Australasia 264lbs.

In France the consumption is said to be 77lbs. per head, and in Germany 64lbs. But in Great Britain the ability to obtain cheap meat led to a steady increase, until last year, when a rise in price consequent upon the decreased Australian production, and the restrictions on American imports, brought about a reduction in consumption. The question is, can it again increase, and to what extent?

We have large figures to work upon all round, for even 2lbs. increase of consumption per head of population per annum in Great Britain would give an enhanced market of one million sterling to the producer, and the ordinary consumption of the naturally increased population gives half a million sterling per annum, with a probable decrease of home supplies. It is not unlikely that the annual imported meat bill of Great Britain will in five years time have gone up by five millions sterling, and the point is, who is to supply it? Every year the shipments of Argentina increase by leaps and bounds, and there are other countries in South America to come on, while Siberia and Hungary have already made a start. The United States may in time be wanting more of its supplies at home, but hitherto, with the exception of 1902, its shipments to Great Britain have shown steady increase.

In 1902 the total imported British meat bill amounted to £47,000,000, of which nearly £9,000,000 worth come from within the Empire. That Australia, which possesses such a large proportion of sheep and cattle per head of population, can increase her contribution by several millions sterling within the next few years I am convinced; the question is, can she stand the competition from outside countries? And by this I do not mean within the Empire, for I decline to regard any of the "five free nations" as other than "friendly rivals."

I have sufficient faith in Australia and Australians to believe that we can hold our own in spite of our distance from the old world, but I do not propose to assert that a little family preference would be unacceptable, to "make assurance doubly sure!" But we must lay to heart the lesson of the drought, for the great essential of success is regularity of supply and unfailing excellence of quality. We must also use every endeavour in this, and other industries, to save expense between the producer and the consumer. There will be no fortunes for the producers, for it is the history of every great productive development that it, sooner or later, through competition, comes down to the level of yielding a moderate margin of profit.

I believe that we must be prepared for the necessity of, ere long, facing much lower prices on this market, but I would hazard the opinion that, if put to it, Australia can raise mutton and beef at 1d. per lb. on the station, which would enable it to be landed here at under 2¼d. per lb. But although there is some market for merino mutton, I have come to the conclusion that, to ensure permanent success, we cannot treat the industry as merely a means of disposing of an intermittent surplus of merino flocks, and that it is necessary to breed what are suitable for the market, and be at some pains to perfect their condition.

Closer settlement will probably do something in this direction, and it is interesting to note the trend of recent years towards a reduction of the number of large flocks, and an increase in the number of smaller ones. The big squatter will probably continue to be the most successful, in certain districts, as a wool-grower, but I believe the smaller man will do better as a meat producer, and that whilst the districts further inland will be confined to merino wool-growing, the raising of, at least a proportion, of crossbreds for meat, will be found more lucrative in the sub-coastal districts. I am aware that this is debatable ground, and I trust that we may have valuable discussion on this important question.

Queensland is chiefly concerned in the production of beef, and in 1901 the value of the export had reached the satisfactory figure of £1,178,851. It is safe to say that no country in the world offers greater advantages for the raising of cattle than Queensland, the ravages of Texas fever notwithstanding. For several years this was a very serious matter, and whole districts were devastated, but experience has shown that, dreadful as the calamity has been, it is of a less permanent character than was at one time feared. The ticks certainly remain, but the cattle are either largely rendered immune, or else the virulence of the fever is abated, for the most seriously infected districts are becoming restocked. The opinion is now very generally held that, with fair seasons and cattle in good condition, the tick is not to be regarded with such dire apprehension.

Considerable extension of the beef export industry may be looked for from the Northern Territory of South Australia. The recently launched Eastern and African Cold Storage Supply Co., Ltd., has acquired 20,000 square miles of land, which is said to be rich in unfailing pasture and well-watered, the rainfall being sixty-two inches per annum. Refrigerating works and slaughtering yards are being erected on the western shore of the Gulf of Carpentaria, which will be several days nearer to Europe than any other meat-shipping port in Australia. The projected railway through South Australia to Port Darwin would open up a large area of cattle-raising country.

Competition in frozen beef has not been, and does not appear likely to become, so severe as is the case with mutton. There is no reason to doubt the ability of Queensland to hold her own in the market, for I would make bold to say that no country in the world

can produce finer beef. The chilled beef from America commands higher prices, for it must be admitted that up to the present the freezing of beef has not led to the same satisfactory results as has attended mutton.

But the inherent good quality of Australian grass-fed beef is admitted, and there is always the hope that improved methods of defrosting will obtain, if indeed, it should not be possible, with the increasing speed of steamers and greater experience, to reverse the verdict given against the feasibility of sending it chilled.

But whilst it is true that nothing equals grass-fed meat, it is also true that dependence upon grazing seriously risks the all-important *desideratum* of regularity in supply, and the question arises cannot our cattle fatteners do something to minimise this by the growth of fodder? In America, stall feeding is very largely resorted to, and in the Argentine Republic lucerne is grown for this purpose. By such means our competitors improve quality and equalise supplies; what can we do in this direction to maintain our position?

Irrigation.

And this brings me to the consideration of a very important question in connection with the development of Australia as a food supplying country, viz., irrigation, which is now beginning to attract serious attention.

Last year the New South Wales Government passed an Act providing for the expenditure of £200,000 per annum on smaller public works under trusts, and since then seventy-five tanks, bores, dams, etc., have been completed, and 100 similar works are in course of construction. Schemes for the utilisation of the water from the rivers have met with a considerable measure of success, notably at Mildura and Renmark on the Murray, and now several far more comprehensive ventures are being initiated for the Goulburn Valley in Victoria, and Riverina in New South Wales, which might bring water to an irrigable area of something like eight million acres, and accomplish the actual irrigation of over one million acres of the best land in Australia. The idea is to enable a small portion of each holding to be irrigated, and thus supplement the rainfall of normal seasons, and prevent loss in drought years. But though the benefit resulting from such schemes will be great, the opportunities for their initiation are confined within limits which, in a large country like Australia, will appear comparatively narrow, and the great far-reaching question is, are there adequate means of making more productive, that vast area of land lying to the west of Queensland and New South Wales, and the central portion of South Australia, and comprising perhaps 250,000 square miles? The rainfall in this country varies from seven to twenty inches per annum, and it is used for the production of wool, or as cattle runs for the breeding of "stores," and in good seasons will,

in certain portions, yield mutton for export. Is the filling of this *rôle* its ultimate destiny?

To assist in forming an opinion upon this great question, I would like to place before you a few facts in regard to the artesian water supply of that region, for although opinions have been expressed that much can be done by surface irrigation schemes, the artesian supply is of vital interest. In 1879, Mr. Russell, the Government Astronomer for New South Wales, made the momentous statement, that the River Darling discharged into the ocean only one and a-half per cent. of the water which it should have received from the catchment area, whereas, the Murray under similar conditions of evaporation, etc., discharged twenty-five per cent. He concluded from this that the water from the Darling area was disappearing, to find exit at a lower level, and surmised that a large supply of good water existed beneath the surface. This led to the putting down of bores at Kellara and Kerribee, in New South Wales, from which latter a flow of 1,750,000 gallons per diem was obtained at a depth of 1,340 feet; and this was quickly followed up in Queensland with even more satisfactory results. Both Governments took the matter up, as did also many private landowners, and there were in Queensland on June 30, 1902, 563 effective flowing bores, yielding 375 million gallons per diem, and in New South Wales 200 bores, yielding 80 million gallons per diem; and the work is being continued in both States, as it also is in South Australia.

To overestimate the value of these fountains would be almost impossible, and it is certain that they contributed enormously to the ability of stockowners to fight the unprecedented conditions of drought that have recently prevailed. But to use the simile of Mr. Boultbee, the Superintendent of Watering Places in New South Wales, these are comparatively but a few "pin-pricks" in the vast artesian area, for it is now known that this large basin has an extent of something like 500,000 square miles, beneath the driest portions of Queensland, New South Wales, and part of South Australia. I know of nothing more fascinating than a study of the geological and practical aspects of this subject, and regret that it is impossible, within the limits of the time afforded this evening, to do more than just indicate them. Geologists are of opinion that the supply is obtained from the rainfall over the porous formation outcropping on the mountain slopes to the north-east and east of the basin, the higher levels of which create the pressure necessary to force the water above the surface of the plains when the stratum is tapped. Dealing with the New South Wales portion, Mr. Pittman, the Government Geologist, calculates that the area of these intake beds on the western slopes of the New South Wales mountains is 1800 square miles, and thereupon he makes a calculation, which enables us to form an opinion on the important practical question of the probable permanency of the supply.

He sees reason to believe that 20 per cent. of the rainfall is absorbed, and if so the supply would amount to 3,580,000,000

gallons per diem, or forty-five times as much as the present New South Wales bores yield. He adds—

"There does not appear to be much reason to fear that our artesian bores will overtake the supply for many years to come."

Dr. Jack, the Queensland Government Geologist, says that:

"The amount of water contributed to the water-bearing chute of the lower cretaceous formation . . . is so great . . . that the quantity abstracted by the artesian wells, even if it were ten times greater, is insignificant by comparison."

On the other hand, it must be admitted that diminution of the flow has in some cases been observed. If the theory of the intake beds is correct, this is, however, no more than would be expected, as the result of the low rainfall that has been experienced recently, and it will be interesting to note the effect produced by the return of normal conditions.

The other all-important consideration is, the suitability of the water for the purposes of irrigation. Considerable pessimism has often been expressed in regard to this, and there is no doubt that some of the bores in Queensland and New South Wales yield water containing an excessive quantity of alkali, and are unsuitable for irrigation, on account of the amount that would in time be accumulated in the soil, to the detriment and ultimate destruction of the plant life. But this of course depends largely upon the nature of the soil, and its depth and drainage conditions.

Two years ago the New South Wales Government sent Mr. Boultbee, the Superintendent of Public Watering Places and artesian bores, to Western America to investigate the conditions under which irrigation is carried on in that country, and he reported that the nature of the water, and the conditions, were very similar to those prevailing in New South Wales. He sums up by saying:—

"I hold the opinion . . . . that the bulk of our (N.S.W.) water can be safely used for irrigation for very long periods, provided care and plentiful cultivation is carried out, and I see no reason (if the advice of Professor Hilyard regarding selection of the land and subsequent use of the water is followed) why irrigation cannot be carried out successfully for an indefinite period," and adds, as a general conclusion, that a great deal more ought to be attempted in this direction in Australia.

The experiments made by the New South Wales Government at several experimental farms, and by some private owners in Queensland, have established the fact that success may be achieved by irrigation in the growing of crops of cereals, fruit and sugar-cane.

Up-to-date information is available from the recent report of the manager of the Government irrigation farms at Moree, in New South Wales, which states:—

"When it is considered that there has not been sufficient rain until this month to assist herbage to grow, and that for miles in

every direction Moree has been nothing but a desolate waste, the fact that this farm has not only existed, but supplied the district with green feed for horses, and on several occasions when starving stock have been brought into Moree for transit by rail to other parts, supplied owners with green feed for a day or two, sufficient to enable the stock to reach their destination alive, makes efficacy of irrigation from artesian bores apparent."

The demand for green feed was so great at times that buyers followed the mowing machines and bagged it almost as fast as it could be cut.

The orchard had only been planted three years and yet many citrous varieties and apricots, quinces, figs, almonds, and mulberries bore fruit in the driest of years. The manager concludes by saying:—

"In my opinion the farm has fulfilled the intention of the Department in proving that in an arid district, with a shade temperature of 100 degrees, where for the whole summer not one inch of rain fell, crops of all sorts and vegetables of many varieties were grown in quantities, and of good enough quality to yield a handsome return to any farmer working similar land on the same principle."

In dealing with this matter I do not wish to present the case in too much *couleur de rose*, or to convey the impression, which seems to be often popularly held, that nothing requires to be done but to multiply bores in order to turn the country into a smiling paradise for the pastoralist. In my opinion, nothing really takes the place of rain for grass-growing, but I believe that a great deal may be done in supplementing the pastures, if indeed the development of other industries is not also possible.

The natural conditions of Southern California are very similar to those of the Western country of Queensland and New South Wales, the rainfall being exceedingly small and unreliable (from six to twenty inches), though the land, on the average, is not so rich as ours. When the rush of settlement took place in California, some previously good seasons had led to the belief that, under natural conditions, it could be turned to profitable account for farming and grazing; but a succession of bad seasons, in which neither grass nor crops grew at all (1868 to 1871) led the distressed people to give their attention to irrigation, largely by means of artesian water, and, as you know, the result has been to turn that country into one of the most wonderful fruit gardens in the world, whilst the growth of fodder for fattening purposes is also considerable.

It is true that our Australian supply lies deeper than is usual in America, and is therefore somewhat more expensive in obtainment, and in outlying districts where the cost of transport of machinery is great, the expense is perhaps, at present, prohibitive. But, on the other hand, our land is rich and cheap, and the payability of the bores, for at least stock-watering, has been proved over a very large area. The watering of the whole of this country

is inconceivable, but even though only a comparatively small proportion can be dealt with, I think we are led to the conclusion that the future holds for it far greater possibilities of food-production, as the result of the freeing of the imprisoned waters from this vast store-house, fashioned and unfailingly replenished by Nature, who, to use Professor Huxley's words, is, "Surely no prodigal, but most notable of housekeepers."

The carrying out of all possible schemes of irrigation from the waters of the rivers, and the multiplication of artesian wells will bring about—

(1.) The better maintenance of our flocks and herds, and, by the growth of fodder, the extension of meat production.

(2.) The enormous extension (as in California) of our fruit production, which will render insignificant our present export of £200,000 per annum.

(3.) The extension of wine-growing.

Wine.

In regard to this latter, however, it should be said that there already exists a very large area of country eminently suitable, both in soil and climate, without the aid of irrigation. The growing favour with which our wines are now being regarded no longer leaves in doubt our ability to produce a high-class article in South Australia, Victoria, and New South Wales; and Queensland and even Western Australia will ere long be added to the list. The wine industry of Europe has been a-making for centuries, and the subtleties of manipulation are not learnt in a few decades. With more experience, and (may we hope?) the help of a little preference, Australia will prove herself worthy to be regarded as the Empire's vineyard.

The total production of Australia is at present about $5\frac{1}{2}$ million gallons, of which the export to Europe is about one million gallons, which proves that Australians believe enough in it to drink it themselves!

Wheat.

Although Australia has exported wheat for years past, it can scarcely lay claim to be regarded as one of the world's granaries. The high-water mark of ascertained production was reached in 1900, when the crop was $48\frac{3}{4}$ million bushels, and in the following year $24\frac{3}{4}$ million bushels, including equivalent in flour, having a value of about £3,000,000 sterling, were exported.

The harvest of 1903, however, is the largest on record, being estimated at 73 million bushels, which comes within close reach of the 78 million bushels raised by Canada in 1903. New South Wales, which has hitherto taken third place in Australia, now heads the list with 28,000,000 bushels, Victoria 26,000,000, South Australia 14,000,000, Queensland 3,500,000, Tasmania 1,000,000.

whilst even Western Australia shows up with 1,250,000 bushels, Of this total about 38,000,000 bushels, valued at £5,500,000, will be available for export.

The yield per acre in Australia is comparatively low, showing the following approximate averages, during the last 10 years of:

Ten bushels per acre in New South Wales; eight bushels per acre in Victoria; five bushels per acre in South Australia.

This does not necessarily indicate inability to profitably raise wheat; and I believe, as a matter of fact, it merely shows that the large areas of land available have led to the adoption of more or less haphazard methods. The yield per acre this year has been far higher, that of New South Wales being estimated at 19 bushels.

The advent of Victoria as a wheat-producing country is a matter of quite recent years, and still more recently has the development taken place in New South Wales. In 1871 Victoria had under wheat cultivation 334,609 acres, and 1901 2,017,321 acres. In 1871 New South Wales had 154,000 acres, and in 1901 1,530,609 acres. In 1871 South Australia had 69,508 acres, and in 1901 1,913,247 acres.

It was the throwing open for settlement, in small areas, of the several million acres of the Mallee lands of Victoria, and their connection to the Government railway system, that brought wheat to the front in that State. The light brush or scrub, which covered the level land, was very readily cleared by the simple, though ingenious, method of rolling it down, and consequently the land could be quickly made productive by men of small means. The early results obtained from these virgin soils may, perhaps, not be maintained, but that the mallee country, of which there is much still unoccupied, will continue to be a large and increasing wheat producer is undoubted.

In New South Wales the extension has taken place in the Riverina district, and more recently in the great belt known as the North-Western and Central, lying on the western slopes of the Great Dividing Range, of which the neighbourhood of Dubbo and Wellington may be regarded as the chief centre. The rainfall varies from 18 to 25 inches per annum. These districts comprise an area of about 30,000 square miles, and there are enormous tracts of suitable land awaiting the plough. Dubbo is but 180 miles direct from the coast, and the limit of distance is less than 300 miles.

Any great extension of cultivated area would have to be accompanied, or perhaps indeed preceded, by additional railways. This must be so in every new country which is deficient in natural waterways. Railways must be in advance of requirements, and if the conditions of Australia were well known to those who criticise her proceedings in this direction, I venture to think that they would come to wonder, not at our prodigality, but at our restraint, and ability to make the lines interest-paying. They would have to fall very far short of doing this before it could be justly said that it

was not in the interests of the community for the difference to be made up from the public exchequer.

In dealing with wheat production I have left out of consideration the question of irrigation, in the belief that, generally speaking, under these conditions it cannot be profitably raised to meet competition in the world's markets; and, moreover, I am of opinion that irrigated lands can, and will, be turned to better account. At the same time there may be areas, having a more or less adequate rainfall, in which the yield of wheat could be profitably increased by occasional watering, if obtained at a low cost.

In catering for the old-world markets, the distance is a handicap to Australia in the case of bulky produce such as wheat, and if we would seriously enter the lists, it behoves us to pick up every item of unnecessary expenditure, and by cheaper transport, and the introduction of wheat elevators and a system of grading, reduce the cost of handling to a minimum.

The cultivation of those very hard varieties used for macaroni manufacture, which grow in much drier circumstances than bread wheats, would probably be very successful over a large area in Australia, as they have been in similar country in America, though the cost of transport to Southern European markets is a serious item.

When investigating this matter in France, I had practical demonstration of the fact, which is interesting in this connection, that large and increasing imports of the grain come from Algeria and Tunisia, and on account of the former being a French colony and the latter a Protectorate, they are admitted free. When it is remembered that the duty on wheat is 12s. 3d. per quarter, it will afford a striking instance of what other countries do to develop and foster their colonies.

To sum up the item of wheat, it is probable that Australia will only become a great wheat-exporting country under some special impetus; but it is reasonable to look to a very considerable development in the near future, as a result of closer settlement and the opening up of the country by the extension of railways. If Canada is to be the Empire's chief baker, we are satisfied to accept a subordinate position, if we can also play the *rôle* of butcher, dairyman, and vigneron!

Butter.

Of all the items of Australia's food production, butter is probably the most promising; the extension of this industry, even during the recent dry years, has been very remarkable, and it is safe to predict an enormous increase as a result of the return of normal seasons. A strong point about dairying is that, with reasonable management, cows, though probably yielding but poor supplies, may be brought through the dry times, and are more or less ready to yield good returns immediately afterwards. Another

point is that it is essentially a business for the small man, who obtains regular cash payments for his produce and does not run the risk, or incur the financial disability, of the crop raiser.

Moreover, there is probably no purpose to which land in the coastal areas of Australia can be put which is so remunerative as dairying, and on the northern rivers of New South Wales it is largely taking the place of even sugar-growing. No industry offers such a good prospect for the closer settlement of the coastal areas, and great credit belongs to the Victorian Government, which in 1889, at the instance of the then Minister for Agriculture, Mr. J. L. Dow, provided the great impetus by offering bonuses. They were given in this way: £800 for the erection of a butter factory, and £200 for each separating station; whilst 3d. per lb. was paid on all butter realising 1s. per lb. on the London market during the first year, 2d. during the second year, 1d. during the third, and thereafter *nil*. This was probably the best investment ever made by a community, for from *nil* in 1890 the export rose to 14,280 tons in 1900, and the object lesson thus given to the other States led to its expansion there also, and particularly in New South Wales. At the present time there are in Victoria 600 factories and creameries, and in New South Wales 350.

In 1900, the export of butter from Australia reached a value of nearly two millions sterling; it has since declined owing to bad seasons; but the trade is at the present time in a flourishing position, the arrivals upon this market representing nearly 1,000 tons per week, and with rising prospects for the future. Even during the dry seasons there has been much extension of the farming areas, particularly on the north-eastern coast of New South Wales and Queensland, where previous to the introduction of refrigeration, it was deemed impossible to make butter. But the heat which was once the obstacle, is now the handmaid, in that it produces, under the 50 or 60 inches of annual rainfall, the marvellous growth of crops and pasture for which these droughtless districts are famed. When I say that on the Richmond River (New South Wales) alone there were, in 1892, 24,942 dairy cows, and that in 1902 these had increased to 57,567, it will give some idea of the development; for dairy cattle cannot be bought or bred like sheep. Although this is perhaps the richest district we have, I use it merely as an illustration of what will certainly take place in many other parts of the semi-tropical country of New South Wales and Queensland; and in the more southern latitudes of Victoria and South Australia there is much expansion to follow. Speaking generally, I regard the dairy industry as only in its infancy in Australia.

It is impossible to say how important a factor in the butter market Siberia is likely to be in the near future. Last year Great Britain received something like 25,000 tons from that source. So far it is not of a high quality, but organisation and modern appliances will do much: yet there is the disadvantage of a rigorous winter.

The disability of our geographical position, expressed in terms of the cost of cold transport to England, is more than counterbalanced by the cheap and extensive lands, and the advantage of the absence of winter as it is understood in Northern latitudes; and the only country whose competition I see reason to be seriously apprehensive about is Argentina. It has similar conditions, and the same advantage as we have in making butter in summer for shipment to this winter market, whilst it is nearer Europe. Yet the butter like ours, must cross the Equator and be held frozen, and the freight charge, which on valuable products like this is always relatively light, should only be about ¼d. per lb. less than ours.

Any Australian visiting Scandinavia, and having an understanding of dairy matters, cannot fail to be struck with the wonderful results that are achieved in such a crowded area, and under comparative disabilities of soil and climate, or to realise that a great future is before this industry in Australia as it develops to a higher scientific pitch. Our butter-making appliances are probably equal to anything in the world, but we require the production of a more uniformly high quality, and farm management, so as to produce it for export to this and other markets all the year round, and without absolute cessation in dry periods. Any article to secure a reputation on British markets must be uniform in supply, and always before the public, and during past years New Zealand butter has very nearly achieved this position. Another important point is that our butter should be carried at lower temperatures than have hitherto obtained on the long voyage from Australia, for it is now being found that it keeps far better in the neighbourhood of zero.

Looking at the enormous quantity of butter imported into Great Britain—some 200,000 tons annually—and remembering that Australia in its best year only contributed 17,657 tons to this total, we need hardly fear that at present we shall overdo production, though I look forward to the doubling of our export within the next five years, and am confident that, if it comes to a question of competition, we can produce it as well and as cheaply as any country in the world.

Three items of good production, at present inconsiderable in the Commonwealth, will follow the extension of wheat-growing and dairying, viz.: pigs, poultry, and eggs.

Dairy By-products.

The market for pig-meat in this country is very large, forming about one-third of the total meat imports, and being saleable as bacon or frozen pork. Its production is found extremely lucrative in Canada and the United States, as it is also in Australia, on the limited scale hitherto attempted. It is especially a business for the smaller man, and will undoubtedly increase under closer settlement. Although more scientific means of treating skim milk may come into vogue, pig-feeding is at present the most profitable method of its disposal in Australia, and the extension of dairying will mean extension of pig-raising.

Poultry and eggs will also be in surplus supply as mixed farming advances, and the opportunity of sending them across the world in a refrigerated state is fully appreciated. Victoria had made an excellent start in this direction, previous to the advent of the recent dry seasons, and may be expected to very soon appear again on the market.

Rabbits and Hares.

The exportation of frozen rabbits and hares is assuming considerable proportions, the number being something like 12 millions per annum, valued at £300,000. The conclusion seems to have been reached that, as the rabbits cannot be exterminated, it is better to make an industry of them. The extent to which they exist may be gathered from the fact that, under the old method, in one year the New South Wales Government paid for the destruction of 25 millions.

Sugar.

Cane sugar is an important production in Queensland and parts of New South Wales. The quantity raised is about 140,000 tons per annum, which meets two-thirds of the requirements of the Commonwealth. But a consideration of this industry would lead into the thorny paths of the black labour question, which I am not competent to deal with, and as sugar is not likely to become an item of export to the old world, in face of the competition of European beet sugar, and for other reasons, I leave it with this passing mention. It should be stated, however, that some success has attended the cultivation of sugar beet in Victoria, and a resuscitation of this industry is probable.

In attempting to embody within the limits of a paper a statement of the food-producing capabilities of the Commonwealth, it has only been possible to treat, with any degree of fulness, the main industries, and another paper would have to be written on the possibilities of the many minor products which at present find consumption within its borders. In speaking of Australia it is seldom realised that its diversity of climate and soil is such that, between Tasmania in the south and Queensland in the north, it is possible to produce every description of food known to man, and most of which, indeed, is to greater or lesser extent actually being raised.

Australia's great need is more rural population, and I think that many among my audience will have been feeling as they listened, as I have felt as I wrote, that herein lies the weakness of it all—where are the sowers and the reapers for this rich potential harvest?

That these four millions of strenuous, resourceful people have done much is without doubt, and that they will do more is equally certain; but the natural increase of population is insufficient for any young country, and it is evident that the full development of Australia must be brought about by a flow of agricultural immigration.

The Premier of Australia recently referred to this as "the problem of problems," but it is one which I submit concerns the mother country also. Professor Boscawen tells us that in that "First of Empires," which he has so vividly pictured from the study of Babylonian and Assyrian lore, it was held to be a sacred duty to cultivate the land. Can it be said that in this latter and greatest of Empires the obligation has diminished? Or has it extended to the development of the lands of our neighbours?

I believe it to be demonstrable that, under organisation, this Empire can be made mainly self-sufficient in food supplies, and at no ultimate increased cost. Whether the consummation of an Imperial scheme to encourage and hasten this development is nigh at hand I know not, but in any case it will appear certain to those who best know Australia, that this bright jewel in the Empire's crown must ultimately fulfil the high purpose of a great food-producing country, for which it has been destined by Nature.

SOIL INOCULATION.

A correspondent, in writing on the subject of soil inoculation, says:—

"I was much interested in the article 'The Scientist and the Food Problem,' taken from *Harper's Magazine*, and appearing in January number of the *Journal*, especially 'Soil Inoculation.'

"Some weeks ago we had discussed the feasibility of growing lucerne by getting some tons of soil from one of the Eastern States where lucerne was growing.

"However, a far more convenient way would be to buy the bacteria from America; and I should be obliged if you would give me more definite information on the subject, as to address of the manufacturing company, etc."

The matter having been referred to the Horticultural and Viticultural expert, Mr. Despeissis reports as follows:—

"The promises of pure nitrifying microbes may be compared with those held forth by the advocates of pure fermentation levures. They open out fascinating vista, but in the hands of those who imperfectly understand their working, threaten to prove disappointing.

"A few advanced industrials have of late advertised parcels of specific microbes, which will cause lucerne, peas, beans, etc., to thrive where they refused to grow before. As yet, these reputed pure cultures have only yielded satisfactory results where the conditions

of soil fertility were favourable. Soil inoculation has hardly yet reached the practical stage.

"Every fertile soil contains these beneficial micro-organisms, pure sand, very dry land, and swampy, unhealthy peat soil being the only ones where they have not been detected. Soils rich in organic matter and lime, and which are fresh, healthy, and well aerated, are teeming with them. The preparations known as Nitragin and Alinit are active only in mediums rich in organic matter. Deep cultivation and liberal dressings of gypsum and bonedust will, in my opinion, do more good than inoculation with so-called cultures as yet of problematic value.

"It must also be born in mind that the introduction of soils rich in tubercle-forming bacteria from abroad would be costly, as some hundreds of pounds of such soil would be required to properly sow an acre of ground; and, also, that there is often a danger of introducing in that way germs of plant diseases. Of late, pure cultures of germs of nitrification, which, when sown in gelatine, proved a failure, have been transmitted to long distances on sterilised porous earthenware discs. These are simply soaked in water containing the requisite nutrient salts for the propagation of the germs, and in due course mixed with soil and harrowed into the ground it is desired to sow. This method, however, which is the most promising, is as yet in the experimental stage."

CORRESPONDENCE.

INSECT PESTS AND THEIR TREATMENT.

To the Editor.

Sir,—I am not desirous of stirring up a controversy, but as both Mr. Compere and yourself are evidently expecting a further statement from me, I will endeavour to state clearly my position in the matter of insect control.

In the first place, I am not prejudiced against using the so-called "natural means," but believe in adopting any and every method of warfare that is effective. I believe it is wise to devote much attention to the introduction of beneficial insects, and were this matter not already provided for here in California, in the office of the State Commissioner of Horticulture, I should certainly devote some of the energies of my department in the University toward this end. Because I have thus refrained from trespassing on the chosen field of work of the State officers and have protested, as in the present case, against gross misrepresentations, I have been quoted as an enemy of the method. I believe that Mr. Craw and the other

members of our State Commission understand and appreciate my position in the matter.

The work is one that should not require falsehood or misstatement to bolster it up: indeed it is injured in this way more than in any other. If there is one criticism I have to make against this work in California, it is that our officers have not been careful enough in making sure as to the accuracy of the statements they have printed and given to the world. Mr. Compere's article, which I criticised in my former communication, is full of inaccuracies, due probably to his lack of personal knowledge of the condition in California at the present time, and I intended my remarks to be taken as a general protest against this sort of statement. I did not deem it necessary to specify the particular errors. If that is desired, however, I have no hesitation in stating that the remarks quoted on page 568 of the *Journal*, in reference to the present condition of the orchards as regards scale insects, is absolutely and entirely false.

The quotations from the report of the State Board of Horticulture, given on pages 568-571, have no particular bearing, since my remarks were based largely on reports mailed to me by these very same people on a blank, headed as follows:—

"Professor C. W. Woodworth:

"Dear Sir,—According to my best judgment, the following are the most injurious insects in this region."

I do not think any one filling this out would doubt that the information wanted is a list of the insects *now* injurious. Indeed, my whole communication was intended as a frank, straightforward statement of the present condition as I saw it, and the replies to my inquiries were given merely to show how others, all over the State, who ought to know their own local situation, viewed the same matter.

I do not think I will make any comment on Commissioner Barry's report, given on page 572, as his district is a part of this country with which I am not particularly well acquainted. I will give, however, as Mr. Compere desires, our experience on the University Grounds with the black scale and the *Rhizobius ventralis*. Not one colony, but several, were liberated on these grounds, and they found abundant food, and have done well. They are common insects, and have been common for at least eight years. Since our trees are not grown for commercial purposes we have neither sprayed nor fumigated during this time, and indeed most of the ornamental trees on the grounds have never been treated in any manner since the grounds were originally planted. Had we maintained commercial orchards it would not have been profitable to have allowed them to remain so dirty. The black scale is now in practically the same condition as regards abundance that it was before the introduction of the ladybird; that is, the *Rhizobius* has not appreciably affected the numbers of the black scale in this

locality. Trees do not remain year after year equally infested, but will be cleaner one year and worse another, and sometimes the pepper trees may become relatively clean, and the olives or the pittisporium hedges dirtier than usual, or perhaps one lot of citrus trees be black with smut, and a short distance away another lot remain conspicuously free from scale. This variation was as pronounced before the introduction of the *Rhizobius* as since that time. I have been unable to find a case where the greater numbers of the *Rhizobius,* or of any other predaceous or parasitic insect, would give reasonable grounds for supposing that they were responsible for such variations in the abundance of the scale.

I am acquainted with cases quite otherwise in the Southern part of the State, but even here no one has given the matter the kind of attention necessary to enable him to have a sound scientific opinion upon the question.

Economic entomology has practically had its whole development within the last half century. Before that time the means used against insects were nearly all of no value, and agriculture is older than history. If left to itself Nature ultimately comes to a balance, no matter how much man disturbs it. If we were content to plant and tend an orchard for the crop the insects will leave us, we will generally have something for our pains, even though we left the insects alone. Possibly certain crops would have to be abundant in some localities if this let-alone policy were reverted to and we could accept the worm-hole and the work of the scale as a dispensation of Providence, as our forefathers did.

The whole trend of development in agriculture is away from that condition, however, and a progressive fruit-grower is not content to wait for Nature to reach a balance, nor with the balance when it is reached, if, by making the proper expenditure for spraying, he can reap a profit on that investment.

I would not be surprised if the time should come, in the case of the Cottony Cushion scale, when our growers will not be content to wait for the increase of the *vedalia*, but will fumigate for it as soon as discovered. The time has not been reached yet, and we consider the *vedalia* the one great success thus far attained in introducing beneficial insects. No other insect that has been here long enough to demonstrate its powers approaches it in effectiveness. What the recent importations may bring forth, time alone can tell.

The factors that determine the degree of success an insect may have, either as friend or foe, are very far from being fully understood, and the presence or absence of insect enemies is certainly, in most cases, a very small item. I strongly indorse every effort to widen our knowledge of the interaction of insects upon each other, and to utilise these facts in the protection of our crops, but would as strongly condemn the narrow point of view that would restrict all efforts for the prevention of losses from insect work to this one method.

Yours, etc.,
C. W. Woodworth.

THE CODLIN MOTH.

(Continued).

The preference is maintained throughout the year with the later broods, though the insects never cease to lay upon the leaves, but deposit perhaps a third of their eggs in such situations. The part of the apple last to become smooth is the hollow of the two ends, and it is the rarest thing to find eggs in these situations, even after they do become smooth. The commonest place to find the egg is upon the side most exposed, and they are laid here at random without regard to any peculiarity of the apple, and sometimes in considerable numbers. Half a dozen eggs upon a single apple is no uncommon thing where the moths are abundant; for instance, in the neighbourhood of packing-houses.

As to the time of egg-laying there seems to be a great difference, according to the locality. In some places it is very evidently conditioned upon the weather. One may find, for instance, upon a tree the majority of the eggs in about the same stage of development, indicating that they were laid probably the same day. Apparently this evident periodicity in the laying of eggs is dependent upon the effect upon the moth of weather conditions. Everyone has noted that some evenings insects will be extremely abundant about electric lights, and that possibly the very next night there will only be a stray insect here and there. It is supposable that the weather condition which effects the moths which we find about lights would also have an equally striking effect on the activities of the codlin moth, and that unfavourable weather would prevent the laying of eggs sometimes for days at a time. This at least seems to be the most feasible explanation of the practical immunity of one portion of the Pajaro valley from ravages by the codlin moth. That portion of the valley between the city of Watsonville and the sea is apparently free from these insects. In some orchards the codlin moth has been introduced repeatedly upon fruit boxes and has been observable in some cases the succeeding year, but the uniform testimony of the orchardists of that region is to the effect that this slight attack never lasts longer than a single season. One of the characteristic features of the climate of the Pajaro valley is the fogs that float in from the ocean with the afternoon winds, causing a chill in the atmosphere at just the time of the day that the moth would ordinarily be active; and the regions where the greatest evident periodicity in egg-laying was observed is immediately adjacent to the immune area. Apparently, in this area showing periodicity in egg-laying the conditions are such, during most of the time, that the moths are prevented from flying, but now and then there comes a day in which they can lay their eggs, so that these areas may be nearly as badly infested with worms as though the weather was favourable all the time.

We have two classes of localities free from the codlin moth in California. Those interior points, especially among the foothills, where young orchards are isolated from other orchards and which have not yet become infested with the codlin moth; and such areas as this part of the Pajaro valley, where apparently the vicinity of the sea produces a permanent immunity. Such permanent immune areas are found all along the coast, from the northern end of this State southward, certainly at least to Santa Barbara county. Judging from the experience in the Pajaro valley, orchards but a short distance inland from the perfectly immune area may be very seriously injured by this insect.

There have been very few observations of the hatching process, and I am not aware that there are any detailed published statements in regard to the process of entering the apple. This is a very important matter in the theory of control of the codlin moth. The usually accepted theory is that the worm must receive a poisonous dose before entering the fruit or otherwise it is beyond the possibility of control. How the destruction of the worm might be brought about through arsenical spraying was first clearly expressed by Professor Slingerland of Cornell University, who emphasises the necessity of putting the poison into the blossom cup, in order that the young insect upon hatching from the egg would find awaiting it, in the cup of the blossom end of the apple, a quantity of poison through which it must burrow in order to enter the fruit. Another idea was first brought out prominently by Professor Card of Kansas, now of the Connecticut station. He observed that the young worm very often ate holes in the leaves before finding the fruit, and his idea, based upon this observation, was that the poison placed upon the leaf and outer surface of the fruit was quite important in the control of the insect, perhaps as much so as that in the blossom end. The observations made at Watsonville throw a new light upon this problem of the theory of the effectiveness of the spray. Contrary to the observations made upon this insect in eastern and northern regions, a very small percentage of the insects enter the fruit in the blossom end. Of those that might be classed as entering in this place the majority actually enter the fruit outside of the calyx lobes instead of going within the cup.

There are a few worms, however, that entered the blossom end and which could be killed by the application made according to the directions now most commonly given of placing the poison within the cup before attempting to burrow down into the fruit, and will often be found of considerable size and with an appreciable amount of excrement, showing that they have been eating the surface of the cup and still no trace of a burrow. Apparently they have fed simply upon the surface of the fruit and have found that the cavity between the calyx lobes offered sufficient concealment to satisfy them, and have not, therefore, been forced to bury themselves to secure this protection. This habit of feeding on the surface within the blossom cup furnishes the best possible conditions for the efficiency of the sprays applied according to the accepted idea. The

blossoming period in the Pajaro valley, and probably in most parts of the State extends over a considerable time, so that the first fruit setting on the tree often becomes as large as one's thumb before the tree is out of bloom. Long before this, the cup is closed so that if the poison is to be placed where it will accomplish this result there must be more than one application and the first application must be made while the tree is in full bloom. If delayed until after the majority of the petals have fallen, we have positively determined that in some cases no poison will be placed in any of the fruit, since in these cases none of the late blossoms produced apples.

Again, there seems to be very good evidence that many of the worms, often those hatching upon the surface of the fruit, may be killed without ever gaining entrance, either to the blossom end or any other portion of the fruit. We have never observed the actual feeding upon the leaves in the orchard by the freshly hatched worms, but have repeatedly made such observations on worms hatched in the laboratory, and it was evident that the ratio between the number of eggs and number of entrances was very appreciably larger upon unsprayed trees than upon sprayed trees, and the only explanation of this difference would seem to be that upon sprayed trees many of the worms would obtain the poison and die which would otherwise ultimately find an apple and enter the same.

By far the greater part of the worms enter the fruit away from the blossom end, and the process has been followed with great care, both in the laboratory and in the orchard. The commonest procedure after the worm emerges from the egg is to crawl about the surface of the fruit until finding a satisfactory spot, and then to proceed to burrow itself beneath the skin of the apple without tasting a bite of the fruit, simply snipping it off with their jaws and using the particles to aid in forming a protection over the mouth of the burrow. The whole operation, from the breaking of the egg shell until the entire disappearance of the insect, ordinarily does not require more than 15 or 20 minutes, and during the whole time the worm has evidently taken no food, so that it is very doubtful if any of the poison that might be upon the surface of the apple would cause the death of the worm.

As to the places selected for entrance, there seems to be two classes of localities selected. That which is evidently preferred by the worm is the point where two fruits touch, or where a leaf lies against the fruit. In the orchard the upper side of the fruit was very commonly chosen, generally in the most exposed point. This was apparently due to the difficulty experienced by the worm of walking over the surface of the fruit. Like most caterpillars, the codlin-moth spins a small quantity of silk as it walks, and this aids materially in its progress of affording a foothold for the minute claws with which the feet are provided. These claws are so minute that the downy hairs of the young fruit seem to afford even less foothold than is obtained on the smooth surface. Repeatedly in our field observations a young, freshly-hatched worm would sud-

denly lose its hold entirely and fall from the tree. Doubtless, a good many worms perish in this way. The front legs are best able to hold on to the plant, so that usually the body would simply swing round, and when the insect had regained its hold it would then climb upward. Thus an insect would sometimes start time and again to go around the apple, and would be brought back to the upper side by slipping as just described, and finally would proceed to enter the apple on the upper side. A rough surface seems to be preferred to a smooth one, and blotches of lime and poison were certainly not avoided by the worms.

In our breeding-cage experiments, which were conducted in a wax cell covered by a thin piece of glass, the burrows were invariably made either under the edge of the wax ring, or at the point where the cover glass nearly touched the surface of the apple. In this latter case the worm could be observed under the microscope very satisfactorily. It would first make a silken carpet and then spin a series of threads, connecting the glass to the apple, making a strong, but an almost invisible cell for itself, the silken threads being so delicate as to be seen only with the use of the microscope and the proper illumination. After accomplishing this preliminary work the worm would begin the process of excavating a hole for itself, the most difficult part of the operation seeming to be the first breaking of the skin, which would often require a great many attempts before the jaws would tear through into the softer tissues beneath. As soon as the first piece is removed from the surface of the apple the worm fastens it to the silken structure that it has erected about itself, and then another bite is pried off and added to the first, and this repeated until quite a wall of apple chips have been built around the burrow. By this time the worm has made a hole pretty nearly as deep as its body, and finds it necessary to withdraw itself after each bite is obtained. The hole is not dug straight down into the apple, but somewhat obliquely and considerably larger than the diameter of the insect. It is soon, therefore, able to turn itself about within the burrow, and then only pushes its head out far enough to add to the chips already accumulated on the sides, and finally the mass entirely covers over the opening which it has made in the fruit. Up to this time the worm has worked incessantly, and the stomach has received none of the material removed from the apple. Shortly after the completion of the burrow, however, the digestive tract is seen to be well filled with chips of exactly the same character, as far as can be observed, as those that were used in the construction of the covering on the outside.

It would appear from this observation that under the conditions existing at Watsonville by far the larger per cent. of the worms gain entrance to the inside of the apple before the poison can reach them. In sprayed trees it was observed that the majority of the worms died before going deep into the fruit. This is in striking contrast with the history of the worms in unsprayed trees adjoining. There can be no doubt, therefore, that in some manner

the poison that was on the surface of the apple reaches the worm after having gained entrance to the fruit. How this can be accomplished can be explained in one or two ways, possibly there is a gradual solution of the arsenic, the material spreading itself over the surface of the fruit and some of it finding its way into the burrow and there being eaten by the worm. One would expect if this were true, that the worms should show signs of chronic poisoning rather than be killed outright, which appears to be the case. The second possible explanation is that the worms after entering the fruit get out to the surface again and obtain the poison in larger quantities. According to our observations, this seems the more probable. A single particle of the green would, probably, be sufficient in the young codlin moth, to produce violent poisoning. It is a matter of positive observation that comparatively large areas of this surface immediately adjacent to these burrows are eaten off by the insect. This is true both of sprayed and unsprayed trees, and it is only after the insect has increased considerably in size that it penetrates deeply into the fruit. A rather complicated burrow is made immediately beneath the skin of the fruit and while it lives in this surface burrow, it feeds in part, at least, upon the surface of the apple. It is during this period of surface feeding that the destruction of the worm is liable to happen.

A microscopical study of sprayed leaves shows that the particles of green are really found only at rather distant intervals upon the surface of the leaf and fruit, and unless the insect feeds over a comparatively large area of the surface, it is difficult to understand how it would obtain the poison in sufficiently large number of cases to account for the efficiency of spraying operations. The surface eaten over, however, by a young codlin moth larva, as described above, is amply sufficient to enable it in most cases to find one or more particles of the poison on a well-sprayed tree.

The practical bearing of these observations upon the spraying operations (1.) is that they emphasise the advantage of filling the blossom cup in any except in semi-immune areas, like a portion of the Pajaro valley; (2.) the importance of covering the whole tree with poison in order to reduce, as far as possible, the number of entrances, since each entrance means a blemish on the fruit; (3.) the benefit of continuous work, season after season, so as to keep the insects down to as low a number as possible, to further diminish the number of entrances; and finally (4.) during the whole period when the eggs are being laid, the need of extreme care in the spraying, so as to keep the fruit thoroughly and uniformly covered with poison.

WEST AUSTRALIAN BEEKEEPERS' ASSOCIATION.

Report of meeting held on 16th March, at which a large number of beekeepers of the metropolitan districts were present:—

The secretary read the minutes of the previous meeting, which were confirmed; also several communications relating to the honey market, which showed that, although honey was badly wanted by the provision merchants, scarcely any was forthcoming owing to the season being very late and little or no nectar being obtainable from the trees in blossom.

Mr. Sutton, Government advisory expert, informed the meeting that, having travelled over the greater portion of the honey-producing portion of the State, he had noticed that practically what was being obtained in the Southern districts, Bunbury to Wagin, showed fair prospects, whilst further South along the line to Albany things gradually brightened at the latter place, no great cause for complaint *re* scarceness existed.

Communications were received from the branch associations at Wagin and Albany expressing a desire for the appointment by the Department of Agriculture of an expert in apiculture *vice* Mr. Sutton, resigned, and considered that in consequence of the poorness of crop this season, advice would be more required by beekeepers than in a good season, as in all probability before the next Spring arrives much disease amongst stocks may be expected.

This Association decided to give all the assistance in its power to these branches in their endeavour to secure the services of an expert, the secretary being instructed to write a minute to the Minister of Lands; and further, a deputation was appointed to wait upon that gentleman if this course was found to be necessary.

The secretary stated that it was his desire that beekeepers should make better use of the *Journal* of the Department of Agriculture, and to further that object he was willing to devote a certain amount of time to assist the editor (if necessary), providing the beekeepers would forward instructive subjects, whether original matter or clippings from other journals on the matter of beekeeping. The beekeepers present promised to assist in this movement, and considered that our country friends should assist also.

The secretary was instructed to obtain the approximate cost of producing a journal pertaining to apiculture only, similar to the A.B.B., and place the figures before the next meeting.

This association invites beekeepers throughout the State to send in questions on beekeeping which they do not fully understand. The answers will be published in this *Journal* as fully as possible. Questions to be addressed to the secretary of the association or to the editor of the *Journal*.

DISTRIBUTION OF PARASITES.

By E. H. Bailey.

I beg to further report having collected from various gardens in or near Perth, the following colonies of beneficial insects, which have been sent away to applicants for same. In some cases fully developed insects were sent, in others the parasitised scale or aphis:—

L. Hesperidum.—Fourteen colonies. The parasite of this scale is doing good work in Perth, and trees almost covered with this scale two years ago are now nearly clean.

L. Oleac.—Fifty-two colonies collected. In consequence of the large number of parasites of this scale sent away I have to search elsewhere for them, former happy hunting grounds for this scale and its parasites being almost "worked out," as far as the parasites are concerned.

Cabbage Moth.—Four colonies sent away.

Cabbage Aphis.—Twelve colonies collected and sent out, with also larvæ, pupæ, and imago of syrphus fly.

L. Cymbiforme.—One colony bred out from some scale I obtained in a garden in Claremont where I liberated some of these parasites in May, 1903, after breeding them out from some parasitised scale sent us by Mr. Compére from France. The useful black scale parasite, *Myioonema Comperei*, was also bred out from the same colony of scale.

NOTICE TO FRUITGROWERS.

FUMIGATION OF TREES INFECTED WITH THE SAN JOSE SCALE.

During this winter all trees infected with the San José Scale will have to be fumigated with hydrocyanic-acid gas.

The growers will have to provide their own tents, which must be air-tight to be of any practical use.

The Departmental tents will be sold. Particulars of sale will appear in next issue of the *Journal*.

T. HOOPER,
Chief Inspector.

14th April, 1904.

THROUGH THE BEVERLEY DISTRICT.

By C. Erskine May, Chief Inspector of Lands.

Having just completed a round tour of inspection from Beverley, *via* Boyandine, Jelcobin, and Brookton, embracing the way, I had occasicn to go about 100 miles, I beg to submit the following report:—

About seven years ago I made a similar trip, and what was then mostly virgin country is to-day either lying in fallow or else in stubble. Many of the old familiar tracks, some of which I hazarded at the onset of my journey, are blocked by substantial six or seven wire fences, and in most cases have been rudely torn up by the plough. It is not wise to leave the main roads in any part of this district. This in itself is proof of the advancement land settlement has made during the past few years. The first place I noticed where considerable improvements had been effected since my previous visit was the old and well-known farm of Boyandine. Mr. Duncon has kept pace with the times by the extension of his cultivation fields and increase of stock. To the east of Boyandine I visited Mr. Jose, a new selector from our sister State. He has only recently taken possession of his land, but at the time of my visit he had some 60 acres cleared, and he with his sons were busily engaged with the fire stick in burning the timber down. These people are well satisfied with their holdings, but complain of the want of a road to the nearest station, Mt. Kokeby. Proceeding onwards, the next place I went to was C. A. Thompson's, another South Australian, who selected about six years ago, during which time he has made good progress in the development of his land. Adjoining Mr. Thompson's are two sturdy sons of South Australia (Craig Bros.), and judging from the excellent improvements they have effected in a short space of time proves them adept agriculturalists. I next visited Jelcobin, a well-know place which formerly belonged to Mr. Brown, but now owned by Mr. G. A. Thompson, another South Australian. Since falling into possession of the present holder the place has been considerably enlarged and developed, and where there were a few acres under cultivation there are now, you might say, hundreds. Varying my course in the direction of Boorabin, I had occasion to inspect the property selected about twelve months ago by G. Tiller, also from South Australia. I cannot pass this selection without going a little more fully into the work he has effected with only the assistance of a labourer. He has cleared 170 acres, ringbarked 1,060, planted an orchard of 2 acres, opened out six soaks, which water 240 sheep and eight great stock, built his dwelling, and nearly completed substantial stable and shed, etc.—all this within twelve months. Passing onwards, I visited the well-known farms of "Glenroy" (Mr. Crawford), also "Woodbine" (Mr. S. Williams); both of these old selectors have and are doing excellent work. Mr. White's farm was also inspected, as also the Fulwoods (father and three sons) from South Australia. These people have selected excellent

agricultural land and were, at the date of my visit, busily engaged in clearing the land. Of the inspections undertaken in the tour no less than eight different families were from South Australia. They one and all expressed themselves well satisfied with their selections, and all remarked on the plenteous water supply, which they state is as deficient in the sister State as ample here.

RELATIONSHIP OF WOODS TO DOMESTIC WATER SUPPLIES.

The following paper, on the "Relationship of woods to domestic water supplies," taken from the *Journal of the Board of Agriculture*, December, 1903, gives useful information upon this interesting subject:—

"This subject has, for more than twenty years, occupied much of the attention of Forest Experimental Stations, especially in Germany, France, Austria, and Switzerland, and in view of its importance the conclusions arrived at may be usefully summarised.

"It has been asserted, and theoretically the contention is doubtless correct, that masses of woodland increase the rainfall. The causes of this result are sought for in the reduction of temperature associated with forests, and in the greater absolute and relative humidity of the air in woods. But although it may be possible to obtain experimental proof by means of elaborate and long-continued observations in a region where extensive afforestation or deforestation is taking place, it may at once be said that such tree-planting, as is practically possible in Britain, can have no appreciable influence on the rainfall. Trees do, however, under certain conditions of the atmosphere, condense dew on their leaves and branches, and this effect may often be seen in the wet state of the ground underneath trees on a foggy morning when the surface elsewhere is comparatively dry.

"But the case is materially different where the fate of the rain and snow that fall on a tract of woodland is considered. The foliage, branches, and stems of the trees intercept much of the rain and snow, so that it never reaches the ground at all, the amount so intercepted usually ranging from 30 to 45 per cent. of the total, but much depends on the character of the rainfall and on the species of tree. In a district of heavy annual rainfall a smaller proportion of the precipitation is caught by, and evaporated from, the trees than where the rainfall is light. Similarly, in the case of heavy and long-continued rain, as contrasted with gentle showers; in the latter case, in fact, but little of the water reaches the ground through the leafy canopy of a dense forest. Then, again, much depends on the kind of tree, evergreens intercepting more water throughout a year than deciduous trees; and a larger proportion of

the rainfall is evaporated from the leaves and branches in summer than in winter.

"But although less rain-water reaches the soil of a wood than finds its way to the ground in the open country, the moisture in the soil is much better conserved in the former than in the latter case. This is due partly to the exclusion of the sun's rays by the foliage, partly to the absorbent and retentive character of the decaying vegetable matter that covers the ground of a dense and well-managed wood, and partly to the air in a forest being more humid, and thus better fitted to discourage evaporation. The lace work of tree roots, too, that occupy the soil of a forest offers mechanical resistance to the rapid surface-flow and percolation of water. It is also to be noted that roots penetrate to great depths, and when they die they leave holes through which water readily penetrates from the surface. The friable condition of the soil of a wood, too, permits ready percolation of water, whereas in the open country the denser character of the surface of the ground is less favourable to the entrance of water. The consequence is that streams in a wooded country are not so subject to rapid rises and falls, the flow being maintained more equally throughout the year.

"Where water supply for domestic or industrial purposes is concerned, the avoidance of violent freshets on the one hand and of scanty flow on the other, is alike desirable. Not only may the water of sudden and heavy floods be lost owing to the incapacity of the reservoir to contain it, but such floods have also the disadvantage of carrying much mud and similar material in suspension, and this gradually silts up reservoirs, besides entailing increased expenditure in filtering.

"It may be pointed out that the water of a reservoir surrounded by well-stocked woodland is not subjected to the same amount of violent agitation during gales as is the case where such sheltering agency is absent. The mud and silt deposited on the bottom, and especially along the margin, is, consequently, left comparatively undisturbed, with corresponding advantages in the matter of purity.

"When a catchment area is covered with trees and with the vegetable matter that accumulates on the surface of the ground, the water that reaches the soil as rain is impeded in its flow and its evaporation is hindered, so that the general effect is equivalent to an increase in the size of the reservoir. It is also important to note that snow melts more slowly underneath trees than in the open country, so that at a time of thaw the snow-water is yielded up more gradually.

"Forests not only affect the degree of moisture in soil, but they also exert a considerable influence on the soil temperature. Although this influence is greatest at the surface of the ground, it is also perceptible to a depth of several feet. On the average of a large number of Continental Stations, it was found that woods of various species and ages depressed the mean annual temperature at the surface of the ground by about 2·6° F., while even at the depth of four feet the reduction of temperature was 2°.

"This general cooling influence is due to a variety of causes. The foliage of the trees excludes the sun's rays, the decaying vegetable matter that covers the ground prevents the free exchange of air between the soil and the atmosphere, while the water in the soil absorbs much heat without its temperature being much affected.

"While woods have a depressing influence on the mean annual temperature, it is found that this effect is much greater in summer than in winter. On the average of 11 German stations, the July temperature of the surface soil in the forest was found to be 7° F. lower than that in the open field, whereas in December the former was rather warmer than the latter. Forests, therefore, tend to equalise the temperature of water collected in them, the temperature being slightly raised in winter and markedly reduced in summer. This result would appear to be of considerable practical and hygienic importance where a supply of water for domestic purposes is concerned.

"To the credit of forests is also to be placed the fact that they exercise a purifying influence both on the air and on the soil, germs of all kinds being markedly scarcer in a well-wooded district than in a similar extent of treeless country."

DALGETY'S REPORT.

Messrs. Dalgety & Co., Limited, wool and grain brokers, Perth, Fremantle, and Kalgoorlie, report as follows for the month ending 9th April, 1904:—

The W.A. grain markets have continued to be quiet in tone, although our aggregate sales for the month have been very extensive.

Wheat.—A large quantity of wheat is still held by farmers, the most of whom are asking prices which are much higher than current rates. Buyers declare that for some time at least they will be off the markets, and, although there is not a strong general inquiry, there are some operators who are showing anxiety to secure parcels on the present markets. Early in the season some millers were offering farmers free storage for long periods, the miller being prepared to pay the farmer market prices, for such wheat stored, at any time to be elected by the farmer. This to a very great measure relieved the miller of the necessity of purchasing very freely, and was consequently responsible for a weaker inquiry. However, it is quite possible that very shortly buyers who have been off the market for some time will have to again commence purchasing, and, although no great alteration in prices could be looked for, the general tone should improve. Farmers are seriously considering the position, and next month, in all probability, a small shipment will be sent to London, on farmers' account. Should this be carried out the market should revive. We sold in the country about 3,000 bags at equal to 3s. 3d. per bushel Northam. We would point out that at present at Perth and Fremantle there are no flour mills, and these markets, as well as Kalgoorlie, offer sale for only fowl wheat. These markets have been well supplied during the past month, and sales were effected at auction at from 3s. 1d. to 3s. 4d. per bushel, according to quality

Algerian Oats.—Farmers are now selling more freely, and during March we handled about 6,000 bags of seed and feed oats, at auction and privately. Formerly on the goldfields (the best market in this State for oats) buyers would touch nothing but New Zealands, but the excessive cost of landing New Zealands has given Algerians an opportunity which was formerly denied. W.A. Algerians seem to be much superior to those imported from Eastern Australia, and there should be a continued good demand for local Algerians. Farmers are now purchasing seed varieties very heavily.

At Fremantle and Perth—Prime seed from 2s. 6d. to 2s. 11d. per bushel.
At Perth—Good feed from 2s. 3d. to 2s. 4½d. per bushel.
At Fremantle—Good feed from 2s. 2d. to 2s. 3½d. per bushel.

Kalgoorlie offers a sale for crushed oats only, and as there are no grain-crushers in Kalgoorlie, the majority of supplies are passed through Perth and Fremantle.

Chaff.—Early in March, at Perth, Fremantle, and Kalgoorlie, the markets were glutted, and prices declined 5s. per ton all round. This had a reactionary effect on supplies coming forward, and for the rest of the month arrivals came more slowly, and prices recovered to the extent of the recent decline, and at the time of this report there was an advance of a further 5s. per ton. It is reported that the recent heavy rains destroyed a large quantity of hay, and in consequence of this and other circumstances, prime green wheaten chaff is now quoting at Northam at £3 15s. per ton on trucks. Prime green wheat and prime oaten (with good colour), are meeting with improved demand, however, supplies of such qualities are light, most of this year's chaff being either of poor colour or weedy.

The market closed very firm at the following rates:—

PERTH AND FREMANTLE.

Prime green wheaten chaff, £4 per ton.
Good quality wheaten chaff £3 12s. 6d. to £3 15s. per ton.
Prime oaten chaff (in good demand), £4 per ton.
Good oaten chaff (dry), £3 5s. to £3 10s. per ton.
Inferior samples of oaten and wheaten chaff from £2 5s. per ton upwards.

KALGOORLIE.

Market very firm, supplies light.

Prime green wheaten chaff, £5 per ton.
Good quality wheaten chaff, £4 12s. 6d.
Oaten chaff, also inferior qualities, poor demand.

We sold at auction, and privately, about 3,200 tons of chaff.

Hay.—Manger (oaten), has been in good demand. Sales were effected at up to £5 5s. per ton.

Wheaten and Fair Oaten.—Machine-pressed, suitable for stock shippers, was in poor request, although at the time of this report the demand is again becoming strong. Nominal value at Fremantle, £3 5s. to £3 7s. 6d. per ton. Fremantle is the only market offering any sale for hay for stock purposes.

Straw, Pressed.—Limited demand. Nominal value for ordinary wheaten, £1 10s. per ton on trucks, Northam.

Barley (Milling).—No local forward, nominal value 3s. 1d. to 4s. per bushel at Perth. Cape has been in good demand for seed purposes at 3s. 6d. to 3s. 9d. per bushel.

Season.—Right throughout the agricultural districts of W.A. there has been splendid rains, and ploughing and seeding is now in full swing, in fact some of the crops on the Eastern Goldfields Railway are already showing.

GARDEN NOTES FOR MAY.

By Percy G. Wicken.

The splendid fall of rain which fell in almost all the South-Western districts of the State during the latter days of March will be of great benefit to those engaged in gardening operations. Over one and a-half inches having fallen in two days, will give the ground a sufficient soaking to enable seeds and plants to be planted out fully a month earlier than would be the case in an ordinary season. Those settlers who have got their ground prepared and manured in anticipation should be able to raise some exceptionally early vegetables this season, both for their own use and for market purposes. as the plants will be able to get a good start before the cold weather sets in. The compost heap should now come in very acceptable as a liberal supply of manure will be required. A compost heap should be made on every farm. All vegetable matter and rubbish that will decay may be placed on it, together with all ashes and bones from the kitchen and the cleanings up of the fowl-yard, pig-sties, etc. This, in the course of a few months, will accumulate into a good-sized heap, and will help very considerably to reduce the bill for artificial manures. Drainage is another matter that will require attention. We shall soon have plenty of wet weather, the ground will become waterlogged, and plants will not flourish in stagnant water; and unless the ground is naturally drained by a gravelly subsoil, steps should be taken to keep the water moving, either by a system of underground drains, constructed of agricultural pipes for preference, or else of stones, slabs, poles, or other suitable cheap material, or by good open drains on the surface. The underground drains are much to be preferred, as they are not in the way of the implements used to cultivate the soil, and also by drawing the water through the ground they cause the air to penetrate through the pores of the soil, which is thus sweetened or aerated. Artificial manures, if used for the garden, should not be put too deeply in the soil; they should be applied near the surface, or better still, in the form of a liquid manure when the plants have obtained a root-hold.

Asparagus.—Dig a trench about 2ft. deep and throw out the top soil on one side and the subsoil on the other, place the soil back in the same order as it came out. the subsoil at the bottom, mixing thoroughly with good stable manure as you do so, and the bed will then be ready for planting out in the Spring.

Beans (Broad).—A farther supply of this vegetable may be sown this month. They should be sown in drills from 3ft. to 4ft. apart. If the flowers on these plants do not set, it is a good plan to pinch off the top of the plant, which will often cause them to bear heavier crops. In small gardens it is better to plant these in rows six feet apart and plant a row of cabbages or cauliflowers between.

Beet (Silver).—A few plants may be sown to keep up a succession.

Brussels Sprouts.—Are very little more trouble to grow in a cool district than cabbages and are treated much in the same way They make a splendid vegetable and are a welcome change. They require a liberal supply of good liquid manure to force them along.

Cabbage and Cauliflower.—Plant out all the young seedlings that you have available, and if no plants are ready the seed can be sown in drills and the young plants thinned out when a few inches high. These plants form the standard crop for the vegetable garden and can be fallen back on whenever other vegetables are scarce and any surplus supply will be relished by the stock on the farm.

Carrots.—Sow a good supply for home use. If you have any to spare they will do your horses good.

Celery.—Plant out in a well manured trench all the young plants you have and keep hilling them up as they grow so as to keep them thoroughly bleached.

Leeks.—Sow a liberal supply of this wholesome vegetable. They are easy to grow. They are best raised in a seed bed, and when about six inches high plant out in trenches in well manured ground.

Onions.—Sow a good supply of this vegetable; they are always useful and any surplus supplies can be readily sold. They require a very fine well-worked sandy loam soil, and will well repay the attention given in thoroughly working the ground. The expression "As fine as an onion bed" is a well known saying. They will also require well manuring with a good supply of well rotted manure. It is cheaper to raise the seeds in beds and plant out later on, as by this means they are enabled to get a start of the weeds. They should be planted in rows about 15in. apart and from 4in. to 6in. apart in the rows.

Parsley.—A little seed may be sown.

Parsnip.—A few rows may be sown to keep up a supply.

Peas.—May still be sown, the earlier sown ones should now be well forward, and if of the climbing varieties will require staking. Staking peas and training them is a little more trouble than to allow them to run all over the ground, but the increase in the yield will more than repay for the trouble.

Turnips.—A few more rows may be sown, and those already up will require thinning.

Farm.—The early fall of rain at the end of March should prove of great advantage to new settlers as it will enable them to start ploughing earlier than they are usually able to do, and thereby get their land in good order to sow their crops early. During April this year, ploughing on the new ground will be in full swing; this work is not generally able to be done until May, and the bulk

of the sowing will be able to be done at the end of April or early in May. The early sown crops within limits nearly always do best. In many crops smut was very prevalent last season and to prevent this from spreading all seed should be pickled in a solution of bluestone and water, the strength being 1lb. of bluestone to five gallons of water, the wheat being dipped in the solution for from four to five minutes and then drained and allowed to dry before sowing. Another method by which to prevent smut is to dip the grain in water at a temperature of 132° F. for two minutes. The earlier the crop is sown the less quantity of seed is required per acre, as the plants have a better opportunity to stool out than those sown later on. From three-quarter to one bushel per acre is the best quantity to sow. All settlers should carry out a few experiments with manures for themselves and thereby endeavour to find out which manures suit their soils best; but to obtain definite results very accurate accounts must be kept, both as to the area of ground sown and the amount of crop obtained, and also as to the cost of manure and the cost of producing the crop.

THE CLIMATE OF WESTERN AUSTRALIA DURING MARCH, 1904.

This was an unusually warm month in Western coastal districts, but on the Eastern side of the Darling Ranges it was, on the contrary, remarkably cool. We find that, whereas at the Perth Observatory the mean daily maximum was 4·1° above that for previous years, at Coolgardie it was 4·7° below; so that we have the very unusual condition that the Eastern Goldfields in March were considerably cooler than the districts near the West Coast. In fact, the hottest place in the whole State South of latitude 30° was Guildford. Geraldton was very much hotter than usual, the mean daily maximum being 89·1°, or 5·7° above the average for previous years. There were two very unpleasant periods of hot sultry weather, viz., from 28th February to the 8th March, and from the 21st to 27th. Altogether there were 12 days when the temperature exceeded 90°, or more than double the average. Following the former heat-spell were showers in South-West and South districts, and following the latter were general rains throughout the extra tropical portion of the State—in some cases very heavy. On the whole, the rainfall in South-West and South districts was far in excess of the mean for previous years. Elsewhere it was patchy, but mostly above the average.

Pressure was generally below the average, especially on the South-West coast.

The Climate of Western Australia during March, 1904.

	Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Shade Temperatures. March, 1904. Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	*Average for previous Six Years. Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Total Points since Jan. 1.
North-West and North Coast:	Wyndham ...	29·814	29·801	29·964	29·600	92·7	75·2	84·0	100·0	72·0	94·7	78·2	104·2	70·0	544	2559
	Derby	29·806	29·829	29·955	29·572	95·0	76·3	85·6	108·2	71·2	95·5	76·8	105·0	64·0	490	2606
	Broome ...	29·800	29·813	29·956	29·544	93·5	78·0	85·8	99·0	71·5	92·9	76·7	102·5	62·8	512	1389
	Condon ...	29·818	29·842	30·096	29·603	94·0	75·2	84·6	101·6	63·0	93·2	73·2	104·0	56·5	81	213
	Cossack ...	29·824	29·820	29·935	29·610	96·3	75·7	86·0	107·0	69·1	96·1	76·4	111·2	65·0	13	240
	Onslow ...	29·826	29·830	29·942	29·629	94·5	74·1	84·3	111·4	64·0	96·8	73·7	112·0	63·0	142	171
	Carnarvon ...	29·857	29·895	30·002	29·687	91·0	70·1	80·6	108·3	64·0	89·7	70·0	110·3	59·0	136	145
	Hamelin Pool...	29·865	29·891	30·040	29·730	95·0	70·0	82·5	104·0	56·0	95·2	66·9	112·8	50·6	26	36
	Geraldton ...	...	29·976	30·150	29·832	89·1	65·7	77·4	105·8	55·0	83·4	62·0	107·0	48·8	91	95
Inland:	Hall's Creek *	29·854	29·872	30·058	29·600	93·0	68·8	80·9	98·0	60·4	93·5	71·9	104·0	54·8	519	2249
	Marble Bar ...	...	...	...	...	101·2	76·8	89·0	110·2	67·0	102·1	75·3	111·4	59·6	242	508
	Nullagine * ...	29·812	29·860	30·007	29·572	98·7	73·3	86·0	104·5	58·5	95·3	70·4	110·0	54·9	44	356
	Peak Hill ...	29·845	29·875	30·070	29·670	94·0	70·0	82·0	101·0	64·0	92·8	69·1	102·8	52·8	5	57
	Wiluna ...	29·868	...	30·100	29·631	92·2	66·9	79·6	101·0	46·0	...	...	...	...	17	21
	Cue	29·900	29·912	30·101	29·704	92·8	70·5	81·6	103·7	55·7	94·2	66·5	108·2	49·5	24	24
	Yalgoo ...	29·884	29·928	30·105	29·646	90·1	65·4	77·8	102·0	53·0	91·9	64·0	107·7	48·6	99	99
	Lawlers ...	29·934	29·985	30·185	29·656	87·4	64·7	76·0	99·0	57·0	89·5	65·2	105·1	46·8	79	89
	Laverton ...	...	29·991	...	...	...	...	...	...	...	88·1	62·3	103·2	48·2	125	140
	Menzies ...	29·995	29·976	30·230	29·810	84·2	62·9	73·6	98·0	56·0	87·3	61·8	105·0	46·0	46	48
	Kanowna ...	...	...	...	...	82·4	57·5	70·0	98·2	51·0	...	...	...	...	26	26
	Kalgoorlie ...	30·017	30·006	30·253	29·759	81·9	58·3	70·1	97·9	51·5	86·0	59·8	104·0	43·8	54	58
	Coolgardie ...	30·004	29·999	30·249	29·772	81·2	57·4	69·3	97·0	54·5	85·9	58·5	104·2	43·5	80	81
	Southern Cross	30·030	29·980	30·219	29·670	85·3	59·1	72·2	95·8	51·0	87·5	56·8	105·6	40·0	165	179
	Walebing ...	...	...	...	...	87·0	61·0	74·0	101·0	49·0	...	...	...	...	200	204
	Northam ...	...	...	...	...	88·1	62·3	75·2	99·0	51·0	...	...	...	...	279	279
	York	29·985	30·013	30·220	29·710	86·0	58·0	72·0	99·0	52·0	87·0	55·6	105·2	41·5	195	197
	Guildford ...	...	...	...	...	88·2	62·9	75·6	101·8	53·0	86·1	56·6	105·8	41·8	190	213

* For the first time means of previous years are taken between 1897 (when the Meteorological Service was re-organised) and 1902 (inclusive). All observations prior to 1897 have been rejected, except in the case of the Perth Botanical Gardens.

The Climate of Western Australia during March, 1904—*continued.*

Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	Shade Temperatures. March, 1904. Mean Max.	Mean Min.	Mean of Month.	Highest Max.	Lowest Min.	*Average for previous Six Years. Mean Max.	Mean Min.	Highest ever recorded.	Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Total Points since Jan. 1
South-West and South Coast:															
Perth Gardens ...	29·972	30·028	30·187	29·725	85·9	65·3	75·6	98·6	57·8	84·0	60·6	104·0	45·4	105	131
Perth Observatory	29·983	30·023	30·188	29·714	85·0	64·5	74·8	97·8	57·4	80·9	60·0	103·7	45·8	116	139
Fremantle ...	29·984	30·018	30·188	29·695	82·4	66·0	74·2	97·0	59·5	78·6	62·2	100·1	48·6	168	191
Rottnest ...	29·980	29·988	30·167	29·627	80·8	65·5	73·2	95·8	59·6	76·2	63·6	94·2	52·2	98	110
Mandurah ...	...	...	...	...	83·7	62·4	73·0	97·1	54·1	81·3	56·2	99·2	39·0	213	232
Wandering ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Narrogin Exp. Farm	...	...	...	...	77·4	55·7	66·6	92·8	48·3	...	...	...	...	156	161
Collie	...	...	...	...	...	...	...	...	...	81·3	48·1	100·8	34·5	...	...
Donnybrook ...	...	...	...	...	81·3	58·0	69·6	96·9	43·7	...	...	...	...	455	519
Bunbury ...	29·970	30·046	30·210	29·690	81·5	61·0	71·2	95·0	51·5	79·2	56·4	96·5	40·6	277	342
Busselton ...	...	...	...	...	80·7	58·3	69·5	94·0	48·0	77·6	51·4	93·8	36·5	305	339
Cape Naturaliste	...	...	...	...	77·5	60·1	68·8	89·0	55·0	...	...	...	...	294	335
Bridgetown ...	...	...	...	...	81·8	51·9	66·8	94·8	41·0	80·3	46·2	100·9	31·0	297	334
Karridale ...	29·945	30·063	30·150	29·610	78·0	58·0	68·0	95·0	48·0	74·5	54·6	101·5	39·0	215	309
Cape Leeuwin ...	29·965	30·030	30·220	29·600	75·5	63·0	69·2	94·6	58·5	71·8	61·0	91·0	50·5	185	314
Katanning ...	30·010	29·032	30·240	29·698	79·9	55·0	67·4	93·0	44·0	80·8	51·4	102·8	35·0	227	242
Albany	30·054	30·057	30·300	29·641	73·5	57·5	65·5	85·0	48·5	72·0	55·5	98·4	4·4	306	421
Breaksea... ...	30·048	30·058	30·290	29·620	70·3	59·0	64·6	76·0	57·8	68·7	58·7	93·0	48·0	237	344
Esperance ...	30·068	30·064	30·335	29·696	77·6	56·2	66·9	88·5	43·8	77·0	57·1	104·4	40·6	199	244
Balladonia ...	30·088	...	30·377	29·720	78·6	51·9	65·2	97·3	42·6	...	...	...	...	34	34
Eyre*	30·097	30·070	30·229	29·700	75·0	56·8	65·9	93·2	45·5	77·8	56·4	105·0	38·2	228	291
INTER-STATE.															
Perth	29·983	30·023	30·188	29·714	85·0	64·5	74·8	97·8	57·4	50·9	60·0	103·7	45·8	116	139
Adelaide	...	30·068	...	...	...	...	...	...	...	81·4	59·2	108·0	44·8	...	...
Melbourne	29·094	29·966	30·299	29·695	68·3	52·7	60·5	79·2	41·7	74·7	54·6	95·4	44·3	95	87
Sydney	29·080	30·055	30·290	29·850	67·0	62·0	64·5	78·0	58·0	75·4	63·1	102·6	48·8	502	1090

* For the first time means of previous years are taken between 1897 (when the Meteorological Service was re-organised) and 1902 (inclusive). All observations prior to 1897 have been rejected, except in the case of the Perth Botanical Gardens.

The Observatory, Perth,
April, 1904.

W. E. COOKE,
Government Astronomer.

RAINFALL for February, 1904 (completed as far as possible), and for March, 1904 (principally from Telegraphic Reports).

Stations.	February.		March.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
East Kimberley:				
Wyndham	708	11	544	15
6-Mile	1042	9	...	...
The Stud Station	...	...	...	...
Carlton	417	6	...	...
Denham	549	8	...	...
Rosewood Downs	...	...	...	...
Argyle Downs	...	...	...	...
Lisadell	325	6	...	...
Turkey Creek	692	9	623	11
Plympton, St. Mary	...	...	...	...
Hall's Creek	447	...	519	6
Flora Valley	...	...	...	...
Denison Downs	129	...	...	...
West Kimberley:				
Obagama	895	9	...	...
Beagle Bay	324	5	...	...
Derby	364	7	490	10
Yeeda	243	4	...	...
Liveringa	88	3	...	...
Mt. Anderson	...	...	...	...
Leopold Downs	...	...	...	...
Fitzroy Crossing	186	7	681	11
Fitzroy (C. Blythe)	...	...	...	...
Quanbun	...	...	...	...
Nookanbah	27	4	...	...
Broome	123	6	512	8
Roebuck Downs	455	8	...	...
Thangoo	...	...	...	...
La Grange Bay	104	6	175	8
North-West:				
Wallal	36	3	360	6
Condon	15	2	81	4
Pardoo	51	4	...	...
DeGrey River	10	1	...	...
Port Hedland	Nil	...	60	6
Boodarie	12	4	...	...
Warralong	67	6	...	...
Muccan	26	2	...	...
Ettrick	102	3	...	...
Mulgie	89	2	...	...
Eel Creek	...	...	...	...
Pilbarra	...	...	...	...
Coongon	53	4	...	...

Stations.	February.		March.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
North-West—*cont.*				
Warrawagine	385	4	...	...
Bamboo Creek	230	8	180	4
Marble Bar	157	6	242	4
Warrawoona	325	3	...	...
Corunna Downs	123	5	...	...
Nullagine	149	5	44	2
Mount Edgar	...	...	...	...
Kerdiadary	10	1	...	...
Roy Hill	...	...	...	...
Middle Creek	...	...	...	...
Mosquito Creek	83	4	...	...
Mulga Downs	47	2	...	...
Woodstock	113	2	...	...
Mt. Florence	285	4	...	...
Tambrey	331	4	...	...
Millstream	Nil	...	...	...
Yandyarra	...	...	...	...
Mallina	...	...	...	...
Whim Creek	24	2	453	5
Cooyapooya	Nil	...	...	...
Woodbrooke	Nil	...	...	...
Croydon	46	2	...	...
Roebourne	38	3	1	1
Cossack	23	1	13	2
Fortescue	Nil	...	20	...
Mardie	Nil	...	...	...
Mt. Stewart	...	...	...	...
Yarraloola	...	...	...	...
Chinginarra	Nil	..	...	...
Onslow	26	2	142	3
Peedamullah	56	1	...	...
Red Hill	40	2	...	...
Mt. Mortimer	Nil	...	...	...
Peake Station	53	2	...	...
Wogoola	Nil	...	209	3
Nanutarra	108	3	...	...
Point Cloates	...	...	...	...
Gascoyne:				
Winning Pool	Nil	...	305	3
Coodalia	...	...	...	...
Towara	Nil	...	...	...
Ullawarra	...	...	...	...
Maroonah	...	...	...	...
Gifford Creek	5	1	...	...
Bangemall	...	...	...	...

RAINFALL—*continued.*

Stations.	February. No. of points. 100 = 1in.	February. No. of wet days.	March. No. of points. 100 = 1in.	March. No. of wet days.
Gascoyne—*contd.*				
Minnie Creek ...	Nil	...	...	...
Yanyeareddy ...	212	5	...	...
Williambury ...	72	4	...	...
Bernier Island ...	21	1	...	...
Boolathana ...	Nil	...	...	...
Carnarvon ...	6	1	136	6
Brick House ...	Nil	...	...	..
Doorawarrah ...	Nil	...	...	...
Bintholya ...	30	1	...	...
Mungarra ...	Nil	...	...	...
Clifton Downs ...	Nil	...	...	...
Dairy Creek ...	Nil	...	...	...
Upper Clifton Downs	8	2	...	...
Sharks Bay ...	Nil	...	10	1
Meedo	Nil	...	124	4
Tamala	Nil	...	40	1
Wooramel ...	Nil	...	13	1
Hamelin Pool ...	Nil	...	26	4
Byro	Nil	...	...	...
Yarra Yarra ...	3	1	...	...
Berringarra ...	Nil	...	...	...
Moorarie ...	15	2	...	...
Wandary... ...	Nil	...	...	...
Peak Hill ...	45	2	5	1
Horseshoe ...	25	3	...	...
Abbotts	Nil	...	5	1
Mileura	Nil	...	...	...
Milly Milly ...	Nil	...	...	...
Manfred ...	6	1	...	...
Woogorong ...	Nil	...	...	...
Twin Peaks ...	Nil	...	...	...
Billabalong ...	...	...	...	...
Wooleane ...	Nil	...	...	...
Yallalonga ...	1	1	...	...
Meka	Nil	...	...	...
Mt. Wittenoom ...	Nil	...	...	...
Nannine	5	1	1	1
Star of the East...	7	1	Nil	...
Annean	Nil	...	24	3
Coodardy ...	Nil	...	..	...
Cue	Nil	...	24	2
Day Dawn ...	9	1	7	1
Lake Austin ...	Nil	...	32	3
Lennonville ...	1	1	26	3
Mt. Magnet ...	Nil	...	41	3
Challa	Nil	.	37	2
Murrum	...	...	103	1

Stations.	February. No. of points. 100 = 1in.	February. No. of wet days.	March. No. of points. 100 = 1in.	March. No. of wet days.
Gascoyne—*contd.*				
Burnerbinmah ...	Nil	...	..	...
Barnong... ...	Nil	...	...	...
Mellinbye ...	6	1	50	3
Yalgoo	6	1	99	5
Wagga Wagga ...	15	1	52	3
Gabyon	Nil	...	...	...
Wurarga ...	...	...	...	...
Gullewa	Nil	...	...	...
South-West Division (Northern Part):				
Murchison House	3	1	...	...
Mount View ...	Nil	...	...	...
Mumby	3	1	...	...
Northampton ...	5	1	90	2
Oakabella ...	...	...	...	...
Narra Tarra ...	...	...	...	...
Tibradden ...	Nil	...	68	1
Myaree	Nil	...	53	4
Sand Springs ...	Nil	...	70	1
Mullewa... ...	1	1	233	5
Kockatea ...	Nil	...	113	4
Geraldton ...	4	2	91	3
Greenough ...	Nil	...	58	1
Dongara ...	2	1	90	1
Dongara (Pearse)	Nil	...	78	1
Nangetty ...	Nil	...	...	...
Mingenew ...	3	2	92	5
Urella	Nil	...	42	1
Yandenooka ...	10	1	58	1
Field's Find ...	Nil	...	...	...
Carnamah ...	1	1	60	5
Watheroo ...	Nil	...	127	4
Dandaragan ...	Nil	...	305	2
Moora	1	1	208	2
Yatheroo ...	5	1	...	...
Walebing ...	4	1	200	4
New Norcia ...	5	1	388	3
South-Western Division, Central (Coastal):				
Gingin	8	2	128	4
Belvoir	15	1	185	5
Mundaring ...	30	2	260	7
Guildford ...	14	2	190	8
Kalbyamba ...	15	2	105	5

RAINFALL—*continued.*

Stations.	February. No. of points. 100 = 1in.	February. No. of wet days.	March. No. of points. 100 = 1in.	March. No. of wet days.
South-Western—*continued.*				
Canning W't'r'w'ks	5	1	143	2
Perth Gardens ...	11	2	105	6
Perth Observatory	12	2	116	7
Subiaco	13	2	104	5
Fremantle ...	8	2	168	9
Rottnest	10	1	98	7
Armadale ...	18	1	...	...
Rockingham ...	20	1	123	8
Jarrahdale ...	51	2	182	8
Mandurah ...	13	1	213	7
Pinjarra	17	1	217	4
Yarloop	27	2	294	9
Harvey	36	2	246	9
South-West, Central Part (Inland):				
Hatherley ...	Nil	...	174	3
Dowerin ...	Nil	...	171	2
Momberkine ...	2	1	...	...
Monglin ...	Nil	...	336	4
Newcastle ...	Nil	...	509	4
Eumalga ...	Nil	...	344	4
Northam ...	Nil	...	279	5
Grass Valley ...	Nil	...	...	...
Meckering ...	Nil	...	261	6
Cunderdin ...	Nil	...	316	3
Codg-Codgin ...	Nil	...	179	5
Yarragin ...	Nil	...	182	3
Doongin	Nil	...	...	...
Cuttening ...	Nil	...	...	...
Sunset Hills ...	Nil	...	272	3
Cobham	5	1	230	4
Yenelin	Nil	...	298	3
York	1	1	195	5
Beverley ...	Nil	...	224	4
Bally Bally ...	Nil	...	266	5
Barrington ...	Nil	...	234	5
Stock Hill ...	Nil	...	214	2
Sunning Hill ...	Nil	...	...	...
Wandering ...	Nil	...	132	6
Glen Ern ...	5	2	240	7
Pingelly ...	Nil	...	165	2
Marradong ...	6	1	167	9
Bannister ...	6	2	...	...
Narrogin ...	5	2	128	4
Narrogin Experimental Farm	...	...	156	5

Stations.	February. No. of points. 100 = 1in.	February. No. of wet days.	March. No. of points. 100 = 1in.	March. No. of wet days.
South-West—*contd.*				
Gillimaning ...	Nil	...	...	...
Bunking ...	Nil	...	...	...
Bullock Hills ...	Nil	...	131	2
South-West Division (Southern Part):				
Bunbury ...	32	2	277	9
Collie	10	2	322	11
Glen Mervyn ...	13	1	299	8
Dardanup ...	...	...	...	...
Donnybrook ...	26	1	475	10
Boyanup ...	32	1	478	10
Busselton ...	23	1	305	7
Cape Naturaliste	10	2	294	8
Lower Blackwood	10	1	320	11
Karridale ...	36	6	215	10
Cape Leeuwin ...	23	9	185	10
Biddellia ...	11	4	341	10
The Warren ...	41	3	312	10
Lake Muir ...	16	2	...	...
The Peninsula ...	8	1	279	11
Mordalup ...	10	3	...	...
Deeside	7	1	...	...
Riverside ...	10	2	...	...
Balbarup ...	11	1	236	8
Wilgarup ...	19	4	172	8
Mandalup ...	...	...	...	...
Bridgetown ...	4	1	297	11
Westbourne ...	15	2	...	...
Hilton	...	...	...	...
Greenbushes ...	15	1	334	...
Greenfields ...	11	1	420	9
Glenorchy ...	8	1	...	...
Williams ...	Nil	...	100	3
Arthur	Nil	...	259	7
Darkan	Nil	...	...	...
Wagin	12	3	129	5
Glencove ...	8	2	162	4
Dyliabing ...	11	3	143	5
Katanning ...	15	3	227	...
Kojonup ...	12	1	221	6
Broomehill ...	10	2	203	6
Sunnyside ...	3	1	177	6
Woodyarrup ...	10	2	177	6
Meanelup ...	6	2	178	7
Cranbrook ...	...	...	...	...
Toolbinnup ...	...	...	156	6
Blackwattle ...	35	2	...	...

RAINFALL—*continued.*

Stations.	February. No. of points. 100 = 1in.	February. No. of wet days.	March. No. of points. 100 = 1in.	March. No. of wet days.
South-West—*contd.*				
Woogenellup ...	12	3	...	...
Mt. Barker ...	14	3	201	8
Kendenup ...	Nil	...	222	10
St. Werburgh's...	10	1	161	9
Forest Hill ...	33	4	213	12
Denmark ...	69	6	...	...
Grassmere ...	39	7	301	10
Albany	24	7	306	11
King River ...	24	5	304	8
Point King ...	12	4	322	8
Breaksea ...	58	9	237	11
Wattle Hill ...	...	...	...	...
Cape Riche ...	17	2	...	...
Cherilullup ...	...	...	143	3
Bremer Bay ...	24	5	335	11
Eastern Division:				
Dural	Nil	...	...	...
Wiluna	4	2	17	4
Gum Creek ...	Nil	...	...	...
Mt. Sir Samuel ...	37	1	21	2
Lawlers	1	1	79	3
Leinster G.M. ...	8	1	...	...
Darda	50	1	37	2
Mt. Leonora ...	8	1	43	5
Mt. Malcolm ...	Nil	...	30	2
Mt. Morgans ...	Nil	...	97	2
Burtville ...	Nil	...	...	...
Laverton ...	Nil	...	125	4
Murrin Murrin ...	26	1	63	2
Yundamindera ..	Nil	...	64	3
Tampa	Nil	...	...	...
Kookynie ...	Nil	...	47	4
Niagara	Nil	...	16	2
Yerilla	Nil	...	...	...
Edjudina ...	Nil	...	...	...
Menzies	Nil	...	46	4
Mulline	Nil	...	52	1
Waverley ...	Nil	...	79	6
Goongarrie ...	Nil	...	51	3
Mulwarrie ...	2	1	83	4
Bardoc	Nil	...	30	2
Broad Arrow ...	Nil	...	23	2
Kurnalpi ...	Nil	...	19	2
Bulong	Nil	...	23	2
Kanowna ...	Nil	...	26	3
Kalgoorlie ...	Nil	...	54	4

Stations.	February. No. of points. 100 = 1in.	February. No. of wet days.	March. No. of points. 100 = 1in.	March. No. of wet days.
Eastern—*contd.*				
Coolgardie ...	Nil	...	80	4
Burbanks ...	Nil	...	87	3
Woolubar ...	Nil	...	45	4
Widgiemooltha...	Nil	...	53	5
50-Mile Tank ...	Nil	...	90	3
Waterdale ...	Nil	...	...	...
Norseman ...	Nil	...	59	3
Lake View ...	Nil	...	...	...
Bulla Bulling ...	Nil	...	100	5
Woolgangie ...	...	...	...	...
Boondi	Nil	...	212	5
Boorabbin ...	Nil	...	163	4
Koorarawalyee ...	Nil	...	187	5
Karalee	Nil	...	185	3
Yellowdine ...	Nil	...	...	...
Southern Cross...	Nil	...	165	1
Parker's Range...	Nil	...	222	5
Parker's Road ...	...	...	...	...
Mt. Jackson ...	Nil	...	...	...
Burracoppin ...	Nil	...	176	2
Kellerberrin ...	Nil	...	206	4
Merredin ...	Nil	...	112	2
Mangowine ...	Nil	...	219	4
Wattoning ...	Nil	...	...	...
Eucla Division:				
Ravensthorpe ...	8	2	199	7
Coconarup ...	20	3	160	6
Hopetoun ...	26	4	248	7
Fanny's Cove ...	Nil	...	...	...
Park Farm ...	9	4	...	...
Esperance ...	23	6	199	7
Gibson's Soak ...	18	4	265	5
30-Mile Condenser	17	3	251	6
Swan Lagoon ...	6	1	222	6
Grass Patch ...	10	2	...	...
Myrup	20	5	...	...
Lynburn ...	19	2	...	...
Boyatup	3	1	...	...
Point Malcolm ...	20	2	418	8
Israelite Bay ...	18	4	347	5
Balbinia	5	1	...	...
Frazer Range ...	Nil		47	3
Balladonia ...	Nil	...	34	4
Southern Hills ...	...	...	...	...
Eyre	15	4	228	8
Eucla	98	5	80	7

The Observatory, Perth,
6th April, 1904.

W. E. COOKE,
Government Astronomer.

By Authority: Wm. Alfred Watson, Government Printer, Perth.

JOURNAL

OF THE

Department of Agriculture

OF

WESTERN AUSTRALIA.

Vol. IX. MAY, 1904. Part 5.

NOTES.

BULLETINS.—A notice appears elsewhere in this issue giving a list of the bulletins issued by the Department, and which may be obtained free on application, or will be posted on receipt of stamps to cover cost of same.

JOURNAL.—The Hon. the Minister for Lands has been pleased to give instructions that anyone wishing for the back numbers of the *Journal* for the years 1900-1901 and 1902 may have the same on sending a penny stamp to cover postage for each number required, or may have the same free on calling at the Department for them.

ANGORA GOATS FOR SALE.—The Department of Agriculture has now for private sale, their first annual draft of Angora goats, These Angoras are all pure bred and of high quality, and are in the fleece. They can be seen by appointment, and the prices are as under :—

	£	s.	d.
Bucks (full-mouthed)	2	2	0
,, (young up to 6-tooth)	3	3	0
Does	5	5	0

MANAGER FOR CHAPMAN EXPERIMENTAL FARM.—Mr. Baird, who was the successful applicant for the position of manager of the Chapman Experimental Farm, has arrived, and has commenced his duties there. For the past ten years Mr. Baird has been the farm manager at Dookie Agricultural College, and has been very highly spoken of, as not only a practical farmer, but as having a knack of imparting sound agricultural knowledge to the students under him. We heartily welcome him to this State, and hope that his career here will be even more successful than what it was in Victoria.

Lectures.—On June 3rd next a series of weekly lectures will be commenced in the Museum of the Department of Agriculture, St. George's Terrace, on the following subjects:—Fruit trees, how to plant and how to prune, kinds to grow and how to market; growth of cereals; manures and their uses; horses, cattle, sheep, pigs, and goats: breeds and their management; poultry, bees, and insect pests. The lectures will be illustrated with lantern views. Admission free. Dates of meetings and other particulars will be found on page .

Bee Notes.—At this time of the year very little can be done beyond seeing that the hives are so placed that they have a slight tilt to the front, so that if the wet should beat in it will drain out again. Many heavy losses have occurred through neglecting to take this precaution. Hives should also be examined on bright, warm days to see if there is a good supply of stores; you must not allow your bees to go hungry. It is also as well to trap and kill off as many drones as possible, as these, at this time of the year, are perfectly useless, and consume a lot of honey.

Work on Experimental Farm, Narrogin.—Notes from Mr. Wicken's report: A large area of heavy timber has been burnt off and the land rapidly cleared and prepared for the coming season. Sowing was commenced on April 25th. Already 50 acres of wheat has been put into new ground, and we are kept continually busy ploughing, harrowing, and rolling for further seeding. The new stone silo is now nearly complete. Its dimensions are—inside diameter, 12 feet; height, 20 feet; and will hold about 50 tons of ensilage. The new students' quarters are now ready for occupation.

Bronze Turkeys for Sale.—At the Chapman Experimental Farm, Geraldton, there are at present about 100 young American Bronze Turkeys for sale, consisting of some of the finest specimens of the breed ever seen in this State. They are bred from birds whose parents were imported direct from America, and all have been reared in the bush under purely natural conditions. Very few of them were ever seen until about six or seven weeks old, the mother birds keeping them in the scrub. These birds are, consequently, very hardy, and well suited for crossing with the ordinary turkeys. The father of them all weighed 39lbs. when 18 months old, and many of the young ones will probably make up even heavier than he. These birds are now for sale to farmers at prices from 10s. to £1, according to quality. All particulars can be obtained from the Manager of the Chapman Experimental Farm, Geraldton.

Pig-eating Sows.—A correspondent writes to the *National Stockman and Farmer*, an American contemporary, as follows:—"Last spring I had a sow three years old. She had always been a

good mother. She gave birth to 13 pigs, and in one half-hour after the pigs were born three of them were missing, and in about one hour three more were gone. Then, as she was very tame and kind, I got where I could watch, and in a few minutes she took one in her mouth, and it disappeared in two seconds. I went for some salt pork, and when I came back only four could be found. I gave her four pounds of the meat—all she would eat—and the next morning only two could be found. As the pigs had nursed, they were very slow to learn to eat; but I took them from her. Last fall she had 13. As I intended to kill her, I thought she would fatten better and be more profitable in cold weather. She began eating them again as before, and had only eight left. I got a large pail of cold water from the well and poured it very slowly on the back of her head—on the brain (if she had any)—and she raised the eight all right. This made her pretty stiff, but she came out all right, pigs and all. One of my neighbours tried the same plan, and the result was the same—it stopped her eating her pigs instantly."

Milk and Maize in Pig-feeding.—For seven years the Vermont Experiment Station has conducted experiments with the feeding of pigs on both sweet and sour skim-milk, and in varying combination with other foods. The sour milk has proved practically as good as the sweet for fattening purposes, and where there has seemed to be any difference it was in favour of the sour milk. The value of the skim-milk during this period varied between 7½d. and 1s. 5½d., and averaged 1s. 0½d. per 100lbs. In one experiment buttermilk was found to have a feeding value of 1s. per 100, and whey of 5½d. per 100. The best proportions of skim-milk and maize meal to feed together have been studied in a number of experiments. The use of 2ozs. of maize meal to each quart of milk yielded pork at the least cost of food, but a more rapid gain was made when a greater proportion of maize meal was fed. In finishing off pigs, more rapid and cheaper gains were made when 12 quarts of skim-milk were fed in addition to all the maize meal the pigs would eat than when but six quarts were thus fed. The feeding of bulky or water foods were found to conduce to a larger growth of stomach and intestines, and hence greater shrinkage in dressing. Maize meal in one experiment produced 11 per cent. better gains than wheat middlings with young growing pigs, and 23 per cent. better than rice meal with pigs weighing about 140lbs. The results of two experiments show more rapid gains on ground than on whole corn, the difference being about 10 per cent. The extra cost of hauling and grinding the grain, it is thought, would probably counterbalance this gain. Wetting maize meal resulted in more profitable gains than feeding it dry. The fertilising value of the food fed in the various experiments has averaged 56 per cent. of its market value. In nearly all the experiments profitable gains ceased to be made after the pigs had attained a weight of 180lbs.

THE FRUIT INDUSTRY.

A Bright Future Predicted.

THE CULTIVATION OF THE ORANGE.

The following additional reports have been received by the Hon. the Minister for Lands from Mr. Grasby, who recently paid a visit of inspection to this State:—

In the Eastern States one so constantly hears Western Australia associated with the scarcity and dearness of fruit that he might be excused for concluding that it is not a good fruit-growing country. I cannot say that I was in that condition of ignorance, because it was what I had heard of its wonderful young orchards that formed one of the strongest inducements for me to come and see for myself. Now, after having inspected scores of orchards and vineyards, large and small, old and young, from Northampton to Mount Barker, and from Katanning to Busselton, I am able to say, without the slightest feeling of exaggeration, that for the growth of the vine, olive, fig, apple, pear, Japanese plums and oranges, including the mandarin, portions of this State are equal to the best fruit districts of Europe, America, or Eastern Australia.

It is my purpose in this report to elaborate the above statement, to show reason for making it, to offer such suggestions as I can in a small way to assist those who are or who intend to engage in the attractive work of fruit-growing, and to give such cautions as seem to be needed to prevent waste of effort. I will also discuss the conditions relating to the growth of other fruits, such as lemons, peaches, apricots, European plums, cherries, etc., which I have carefully omitted from the above comprehensive statement, because one knows that he must fall into error somewhere, and should exercise caution accordingly.

The Orange and Mandarin.

I take the orange first, because I confess that it has been a constant matter of surprise to see how the tree grows. I had had opportunities in Adelaide of sampling West Australian oranges grown at the Harvey River, and now have had the privilege of seeing the trees as they appear, without irrigation, at the end of five months practically without rain. There may be other parts of the world where the orange will thrive better, and bear as heavy crops of as fine fruit with as little effort, but I do not know them. There are picked spots in South Australia, as, for example, at Torrens Park, on the banks of the River Torrens, at Payneham and Marden, and on the banks of the Little Para, at Salisbury, where the orange thrives and bears fruit as fine in appearance and quality as those I have seen from Western Australia. In fact, I do not think it would

be possible to have better; but they will not do so without irrigation, and the trees are not as long-lived as the specimens to be found here and there of old trees in this State indicate that they will be. I would not like to say that the orange tree grows better here, or that the oranges are better than in portions of New South Wales and Queensland. The comparison I make is that, whereas in other first-class citrus localities people either irrigate or have summer rains; in Western Australia the oranges are grown without either. I have seen evidence that in some places better results would be obtained with just a little water in summer, but it would require to be used with judgment.

In this State the marvel is that, although the summer is long and dry, one sees the orange growing luxuriantly under a great variety of conditions, without any irrigation whatever, sometimes with scanty cultivation, and occasionally with none at all. It is also particularly worthy of note that, with one exception, the only orange trees I have seen dying off were in orchards where the trees were irrigated, and were, indeed, being killed by too much water. I would not have it thought that the orange grows, as I have indicated, anywhere and everywhere. Of course, it is only under suitable conditions that it does so well, but there seems to be no practical limit to these conditions. The suitable land where no water is required is usually in distinctly limited areas or patches; but these patches occur so frequently over such an immense extent of country that it will be many years before the available country can be used.

Considering the large and increasing population of consumers, I think that it will be years before the requirements of local consumption will be produced; because it cannot possibly be expected, nor would it be good for the community, as a whole, for past prices to be maintained. Oranges are profitable near Adelaide, sold at from 5s. to 9s. a case, although grown with the added cost of irrigation on land which, in a bare condition, readily realises £100 an acre and upwards. If good fresh oranges were sold in Perth and on the goldfields at from 1s. to. 2s. a dozen retail, who will estimate what quantity would be absorbed. That time is not here by many, many years; when it comes, any trees now planted should not owe the owner anything, and all beyond working expenses will be clear profit. While I can see nothing which promises a better opening than the growing of the Washington Naval orange under suitable conditions, I think it necessary that intending planters should go into the business with their eyes wide open to the fact that the fruit will require to be sold at gradually reduced prices, and they must work accordingly.

The question naturally follows, what shall we do when the limit of consumption is reached? Is there likely to be a profitable outside market? In reply to the first question, I would say that I do not know of an instance of permanent over-supply of any fruit. Temporary gluts there are, of longer or shorter duration, but even during these times there is almost always (I really do not think

that there is any necessity to qualify the statement at all) a margin of profit for those who are working under favourable conditions. That requires no argument. When a thing cannot be produced at a profit, people stop producing; and as the last one to have to cease is the one who can produce most cheaply, *i.e.*, he who is producing under the most favourable conditions, he never has to stop at all.

Ever since I have paid attention to the subject I have been familiar with the cry of over production, but when inquired into it resolves itself into a temporary glut, or a bad adjustment of business. An instance may be given in connection with the past season's apricot crop in South Australia. The year before, *i.e.*, 1902-3, there was a scarcity of apricots in Victoria, and a normal crop in South Australia, part of which was wanted for Melbourne. In the following season, 1903-4, there was a normal crop in Victoria, so that Melbourne did not draw on Adelaide, where the crop proved to be exceptionally heavy, and for a week or two apricots—undersized, poor-flavoured stuff, it is true, but still called apricots—were sold as low as 9d. a bushel in the Adelaide market. At the time this was taking place the suppliers of good fruit were receiving from £5 to £7 a ton from the factories, and all who had trays were drying their fruit. The glut was caused by the fact that the owners of small gardens, who usually have only enough for themselves and friends, found their trees laden to breaking point with inferior fruit, and sent it to market, where there was already a big surplus of poor fruit. The result was that even good fruit was sold at very low prices for a short time, and over-production was talked about. The sequel to the story is that within a few weeks of the outcry about over-production of apricots buyers were almost tumbling over one another to get dried apricots at prices equal to £8 to £10 a ton, after allowing for the cost of drying.

Time and again I have inquired into the cry of over-production with similar results. Three seasons since there was a great cry of over-production of raspberries in Victoria, and so it seemed to the poor grower, who could get little more than the cost of picking; but at the same time one could hardly buy a bottle of genuine raspberry vinegar in Melbourne, and much of the raspberry jam was partly some other fruit, equally wholesome, but not raspberries. For the past two seasons raspberries have been among the most profitable of fruits. I remember talking over this same question with Professor Hilgard, of California, and he put the matter neatly, as he said in effect:—"We have had crokers talking over-production ever since we started fruit-growing in California, and they are talking it yet. In the meantime our production has gone on increasing by leaps and bounds, but our markets keep pace with our production." I have no fear of over-production of good oranges. Growers should grow only the best, grow them in suitable places, attend to their trees properly, pick and market the fruit carefully and attractively, and keep an eye—and a hand if necessary—on the distribution, to see that the fruit gets into the hands of the public who want it.

With respect to outside markets, I believe that such will be developed. I made a careful inquiry with respect to the London market for Australian oranges, when investigating the citrus industry of the Mediterranean, and South Australian growers have tested the market to a small extent. The present position is that the prospects for ordinary oranges are not very good, but there is a limited profitable market for Washington Navels. I do not think that South Australia is likely to have the surplus to supply that market, and, in any case, this State will have a decided advantage over her if it should come to be a matter of competition. This report would not be complete without a reference to several examples of old trees which have helped to form my ideas on the subject. The first in age, size, profit, and interest is, without doubt, the group of 19 old trees owned by Mrs. Fawcett, of Pinjarrah. These are growing near the bank of the Murray River, and form the most interesting group of orange trees I know of in Australia. Mrs. Fawcett informed me that the trees were planted about the year 1860, and were all raised from pips taken from an orange tree then growing at Wongong, near Armadale. It would be interesting to know whether the parent tree is still alive, and its condition. The 19 trees form a small group planted close together in three irregular rows. I find that I have not noted the distance apart, but I think they cannot be more than 10ft. or 12ft. The consequence is that the inner trees have no foliage, except right on top, some 35ft. from the ground. Of course the inner trees should have been removed 25 years ago; but, were they mine, I would look many times and think long before I would have courage enough to interfere with them, and I doubt if I would touch them, for one feels something akin to reverence for such trees.

There is also a camellia tree growing amongst the clump of oranges. It is 27ft. high, and the stem is 39in. in girth. It, too, and an old lemon, should come out if the production of oranges alone were considered; but Mrs. Fawcett rightly feels that she is guardian in the interests of the State, for, so long as they remain, the trees will serve as a positive proof of the thorough suitability of this State for orange-growing. I measured an outside tree, and find the following are its dimensions:—Girth of trunk, 65in.; spread of branches, 33ft.; height, approximately, 35ft. to 37ft. Other trees are quite as high, or higher, and the trunks are as thick, but they have no chance of spreading. The trees are in a perfect condition of health, there being no signs of decay in any one of the trunks, and, beyond a little scale, show no signs of any pest or disease, and the foliage and wood exhibit every sign of perfect health and vigour. The soil is not cultivated, but during the past few years a moderate quantity of water has been pumped from the river and run around the trees in furrows.

It is, perhaps, interesting to record that from these old trees and other younger ones, making probably half-an-acre, the fruit realised £300 in 1902. This year it is estimated that the trees are carrying 500 cases of fruit. I believe the trees did not bear until

they were 15 years old. At the home of the Hon. J. E. Richardson, M.L.C., of Lowlands, Serpentine, I saw several old orange trees nearly as noteworthy. They are growing at the foot of a sandbank, on the margin of a small alluvial flat, near the Serpentine River, and are between 40 and 50 years old. I measured two, with the following result:—No. 1—Height, about 30ft.; spread of branches, 33ft.; girth of trunk at 2ft. from the ground, 55in. At 3ft. it breaks into three branches, measuring 33¼in., 26½in., and 19in. in circumference, respectively. No. 2—Height, same as No. 1; spread, 30ft.; girth of trunk, 46in. At 30in. from the ground it divides into two branches, which, at 5ft. from the ground, measure 33½in. and 29in. in circumference. The trees are not irrigated, and except for, or rather in spite of, the prevalence of red scale, are in good health, and perfectly sound in every way. Did space admit, I could give many other examples, but these will suffice.

With regard to the young orangeries from one to seven or eight years of age, the first impression made on a visitor, even as he passes them in the train, is the marvellously healthy, rich dark-green foliage of the matured branches, relieved by the more delicate shades of the vigorous growth of the young shoots. I have never seen finer blocks of trees in more perfect condition of healthy growth and prolific cropping than, for example, those of the Hon. E. M. Clarke, M.L.C., at Roelands, near Bunbury; the orangeries on the Harvey Estate; those of Sir Arthur Stepney, at Armadale; those at Gingin; Messrs. Whistler and Duce, at Boyanup; Mr. A. F. Piesse and others, at Newcastle; and Messrs. Lauder and Jupp, in the Victoria district. One should also mention smaller plantings on the Great Southern line, for example, at York, Beverley, Wagin, and Katanning, which, although not grown under such favourable conditions as nearer the coast, are yet only slightly inferior in vigour, and not at all inferior in point of healthiness. These are only a few of those I have seen, and I am aware that I have only seen a few of what there are.

The reader will the better grasp the full significance of what I have written when he remembers that Messrs. Jupp and Whistler's orangeries are some 430 miles distant from one another, north and south; that Messrs. Piesse at Katanning and Clarke at Bunbury are about 100 miles distant, east and west. This is a big area over which an intending grower may look for suitable "patches," and when he is looking for orange land he must not allow the price per acre to frighten him from obtaining such as has been proved to be suitable; for Hamlet's advice to the players may be parodied in fruitgrowing to read:—"Suit the tree to the soil and the soil to the tree." I have seen more failures in fruitgrowing through neglect of this essential principle than from any other cause, and in no case does it apply with greater force than to the orange.

VINES AND WINE-MAKING.

I have already stated in press interviews that I do not think that for heavy bearing and quality of fruit the vines grown under suitable conditions in Western Australia can be excelled by those of the Eastern States. I might even go further, but I wish to be cautious, and really, to one who knows, the above statement is the highest praise one can give, for I have always considered the choice grapes of the Adelaide Plains to be the perfection of grapes grown in quantities under general vineyard conditions.

I have, however, noticed that some varieties, such as the Muscat Gordo Blanco, Knight's Centennial, and Wortley Hall, bear more freely, or develop their berries more evenly, than the same varieties do, as a rule, in South Australia. In some cases, too—notably with Mr. Charles Harper, M.L.A., at Woodbridge—not only is the Centennial grape a better cropper, the bunches larger, and the berries more even than in Adelaide, but the quality is vastly superior. This is not always the case, for I have tasted a number of samples of Centennials even more watery and flavourless than those I grow at my home. I consider, therefore, that this vine not only gives the best results when grafted, but is particular as to its conditions.

The Wortley Hall is considered a large but poor grape with us, and ripens very unevenly. Here I find it a very popular variety, and I have inspected blocks of vines carrying heavy crops of grapes of excellent quality, even black colour, and nice marketable bunches. In other places, again, it colours badly, as with us.

All that I have said of the wide range of country over which the orange thrives applies with threefold force to the vine, which is much hardier, and in its many varieties suited to a much wider range of soils and climatic conditions than the orange. I have, however, noted that it has been planted in many places under conditions where I do not think it can possibly prove profitable. The vine is a long-suffering plant; but even in planting vines it is necessary to suit them to the soil and climatic conditions. I am sorry to say that settlers have shown me miserable looking blocks of vines, grown with great care, at great expense, where nature intended apples should be planted. The vines can never prove profitable under the conditions which are rapidly coming, when grapes must be sold at a price to allow even the poorest to eat them. A man who, with care, can only grow from 10cwt. to 20cwt. of poor table grapes to the acre, cannot compete against the one who can easily produce three or four tons to the acre of first-class grapes.

While no Government nursing can protect some men against the results of their inexperience and pet theories, I think it can, and should, guide the reasonable man more than it appears to have done. It is a rule capable of wide application that we never know until we try, and some of the finest results obtained have been where men have been called fools for trying; but when one or more men have paid for experience, there is no need for others to pay

over again. The vine has undoubtedly a great future before it in this State, for it grows like a weed, and all that is needed is to conduct the business on sound business principles.

Wine.

I do not desire to be considered a wine expert, but I am on sound ground in making the following remarks:—

I have had the opportunity of sampling a number of West Australian wines, and am tempted to omit any comment on them, for while all like visitors to pay compliments, and vote them good critics when they say nice things, it is not uncommon to find either their motives or their judgment, or their knowledge or good taste, called in question when they have to say such uncomplimentary things as one must say who speaks the truth about much of the West Australian wine.

On one occasion, at a luncheon, at my request I was given a bottle of West Australian claret from a well-known maker, and on tasting it found it more suitable for pickle-making. If this were a solitary case one would not say anything, but it is an instance among several. Even in cellars I have found the fermenting vats smelling strongly of acetic acid, and the makers did not know it. Speaking generally, and allowing for noteworthy exceptions, the wine-making of the State is in a very primitive condition; and I would, with all respect, forcibly urge upon all interested the fact that fermenting grape juice, and dosing it with spirit, is not making wine. The Government employs a highly qualified viticulturist; but it must be a matter for sincere regret that the general quality of the wine reflects very little credit on the use the vine-growers have made of his teaching. I think that it is very important that something should be done to remedy the existing conditions of wine-making, because the time is coming when the market will be open to the Eastern States, and when, the price of grapes being lower, more wine will have to be made.

There does not appear to be any doubt whatever that the conditions in this State are eminently suited to making high-class wines; and as the art of doing so cannot be learned in a few days, it is desirable that serious attention should be given to the matter, in order that the industry may assume the importance due to it. I find the custom is to sell the wine before it has had time to mature. This, of course, will cure itself in a few years. At present makers do not care to accumulate stocks when each year the protection becomes less, and the price of imported wine lower.

In contrast to what I have written, it is equally correct to say that I have tasted a number of wines which only require care and age to compare favourably with the best wines of the other States. I conclude that the conditions here are in every way favourable for producing high-class wine; but some wine-growers have to learn that wine-making is an art requiring technical knowledge, experience, great care, and the most scrupulous cleanliness in every detail. As

there is no State in which grapes grow more freely and yield better, and as the conditions of the vast areas of ironstone soils are favourable for producing wines of good body and wonderful richness of colour, I think it is highly probable that in the future Western Australia will be found to be among the large producers of the highest quality table wines.

CULTIVATION OF VARIOUS FRUITS.

The Fig.

It is not my intention to write much about the fig, although I feel tempted to do so. The tree grows like a weed anywhere and everywhere, and has great possibilities. At present the second crop of fruit is largely used for feeding pigs, fowls, and even sheep and horses. As the jam-making industry is developed, one of Western Australia's specialities will prove to be fig jam, fig preserve, and canned figs. I would strongly recommend every settler to plant from an acre to ten acres of fig trees. If of no other use, the fig orchard will prove one of the most profitable corners of the farm as a producer of stock food. I will not go into the matter at length now, but attention should at once be directed by the Department of Agriculture to the establishment of the best varieties of the Smyrna drying figs and of the Capri or male fig. When these are established, the Blastophagus or fig wasp should be introduced, and it will be found that quite a new industry will be developed for which I believe there are great possibilities. Mr. Hawter, I believe, has the right varieties, so that there should be no difficulty in dealing with the problem.

The Olive.

At present the olive has little commercial significance in Western Australia, for the only use so far made of the fruit is to fatten turkeys and fowls, or feed pigs. No one who loves this tree as I do could travel through the country without noticing the freedom with which the tree grows, and the heavy crops of berries now maturing. I should like to see olive trees planted round every home, especially in the Eastern, South-Eastern, and Victoria districts; there is no better food for fattening turkeys, and in years to come, when labour conditions adjust themselves, the olive oil industry should make a good showing among the minor industries of the State.

Stone Fruits.

With respect to the fruits already dealt with, I feel that I am on firm ground, and have no fear of any criticism which may be made in twenty or forty years when the forecast will be proved right or wrong. With respect to peaches, lemons, apricots, cherries, and European plums, I am less certain of the real position of things, and can only speak with cautious reservation, and subject to amendment. Speaking generally, one cannot go over the orchards as I

have done, watch the trees, and talk with the growers without feeling very considerable doubt indeed as to the general suitability of the State for growing some stone fruits. Excepting special varieties, such as the Elberta, of which I have seen many heavy crops of magnificent peaches of first quality, my inquiries lead me to the conclusion that the peach tree does not fruit nearly so well nor so regularly as in the Eastern States. I believe that under various local conditions this statement does not hold good, and even as a general statement it may be necessary to modify it, but such is the opinion I have been led to form by inquiries I have made. The large number of trees planted all over the State seems to throw grave doubt on the conclusion, but the explanation may be that the high price makes a small crop profitable. I am open to receive further evidence.

With respect to European plums, I have not had the good fortune to find any grower who could unhesitatingly inform me that the European varieties will bear freely and regularly as do the Japanese sorts.

Coming to the cherry, the position seems to be still more pronounced. I have seen old cherry trees here and there, and almost everywhere the reply was they gum badly and do not bear. There are two possible exceptions, viz., those of Mr. F. H. Piesse, M.L.A. (Katanning), who had, I believe, found the trees profitable, and I really see no reason why at that elevation they should not do moderately well; the other exception is a block of trees in the orchard at Donnybrook belonging to Dr. Hackett. The trees look well enough, and, Dr. Hackett tells me, produced a profitable crop last season for the first time. I have suggested that the trees be left alone, so far as pruning is concerned, for a few years. There is no excess of vigor, they are full of fruit spurs, are not gumming more than is common, and if the same trees were growing at, say, Doncaster, near Melbourne, they would be considered good profitable looking trees. The cherry thrives best on a deep, well-drained loam, and after the first two or three years' pruning to form the tree it is best left alone, at all events until it settles down to fruiting. I cannot say why the deep, friable, loamy hillside soils derived from the diorite dykes of the Blackwood district should not suit the cherry, and I certainly think that further experimental planting should be carried on. I would suggest planting Bigarreau Napoleon, Black Eagle, Black Republican, and Margaret, all of which bear heavily and consistently with us. Planters should avoid the flats, avoid cold, wet soil, and select sheltered hillsides, with soil such as I have indicated, giving the preference, other conditions being suitable, to an eastern, south-eastern, and southern aspects.

The Apricot Problem

has been one of the most interesting and bewildering I have met. On the one hand, I have seen finer trees here than anywhere in Australia. At Mr. T. James's place, Paradise, on the old Albany Road, a few miles from Armadale, or say 23 miles south of Perth,

there is an apricot tree about 60 years old, in perfect health, and making nice growth every year. At two feet from the ground it measures 59 inches in girth. Near by is a group of even larger and finer trees, probably 40 years of age. If those trees bore as apricot trees should, they would be as noteworthy as are Mrs. Fawcett's old orange trees. At the Harvey I saw a block of apricots, which, if they bore as trees do in South Australia, would produce probably 600 cases per acre; but they don't, and I cannot guess why. Occasionally I hear of profitable trees, but rarely. Here is a problem to be worked out. There must surely be places in this great State where the apricot will thrive and bear well. I should like to sea a block tried on the chalk hills on the estates of Messrs. Edgar, Wedge, and Harper, at Gingin, and any other places away from the humidity of the sea where lime is present, for the apricot loves limestone soils, and thrives best under dry atmospheric conditions. The most feasible guess I can make is the absence of lime inland, and the sea breezes near the coast at the time of setting, together with the mild autumn weather, preventing the proper maturing of the blossom buds. One puts these guesses down as his contribution to a problem which he would like to see worked out.

The Lemon.

I must say a few words about the lemon. I have seen finer trees for their age on the Harvey and near Bunbury than anywhere in Australia. The trees, too, were carrying good crops of fine quality lemons. The facilities for importing Sicilian lemons during the summer season has been an important factor in preventing the planting of lemon orchards, but another, if not the chief reason, is the fact that lemon trees have not proved long-lived. The cause of the great loss of trees is what is called collar rot, a fungus disease which attacks the tree at the base or just above and below the ground. As the conditions here are favourable for the production of good lemons, it is important that a means be found for preventing the trouble. So far as present trees are concerned, the soil should be kept well away from the base of the trunk. When an attack begins, the earth should be cleared away, the bark cut from the affected part and burnt. The wound and the whole base of the tree should be swabbed with a solution of bluestone, say, ½lb. to a gallon of water. Afterwards the wound (not the sound bark) should be painted with tar, either Stockholm or coal will do. The roots should be examined to see if root rot is not the primary cause, and if it is the tree may as well be pulled out at once. In Sicily I found that, owing to this same trouble, growers used nothing but Seville orange stocks for lemons, and I think that anyone planting would do well to make absolutely sure that his trees are worked on this stock. Nurserymen who do not use this stock will do well to adopt it both for oranges and lemons.

Type Orchards.

In going round the country among the orchards, I have been struck with the great confusion there is in the naming of fruits,

and I think it would be as well to start an orchard for the purpose of—(1) establishing the correct names of the varieties of fruits being grown in the State; (2) testing the most suitable varieties; (3) providing reliable scions true to name and from pedigree trees, *i.e.*, from trees proved to be true to type, healthy, and prolific bearers; and (4) for general experimental work.

With respect to the third object, it will be readily seen that if one orchard is planted with trees worked from proved bearing strains, and another from trees with no such habit, the profit from the one may be as much as double that from the other.

We have an orchard worked on these lines in South Australia, and, although young, it is already proving of great educational value. By securing the co-operation of Dr. Holtze, director of the Botanic Gardens, who has charge of it, an immense amount of the preliminary work could be avoided, and I am confident that the orchard would prove of great value to the fruitgrowers.

THE CULTIVATION OF APPLES.

What wheat is among cereals, what the potato is among vegetables, the apple is among fruits. We look forward to the peach season, we await with impatience the ripening of the grape, we anticipate strawberry time or the blackberry season, and make the most of raspberries when they are in, knowing that their season is brief; and it is well that it is so, for were they with us always we should long for something else as deeply as those who are compelled to continually eat salmon.

A Useful Fruit.

But whoever heard of anyone getting tired of apples? Ever since the serpent tempted Eve with a Bridgetown Jonathan apple—large, rosy, juicy and rich—literature teems with the praises of the apple. All the year round we have them, and are never tired of them. In the kitchen we make pies of them or case them in the choicest paste and make apple dumplings to puzzle royal heads as to how the apple got inside. We bake them, we stew them, we jelly them, and in each way we enjoy them, and are the better for them. We can use them before they are ripe, and we can keep them for many months until apples come again. We can send them from one side of the earth to the other, and almost forget that there is an apple season. We can dry them, and then our explorers in the tropics or within the polar regions may still enjoy apple pie on an iceberg or under a cocoanut palm. Finally, we can make cider or vinegar from the plentiful juice, and the residue or pomace forms an excellent food for cattle or pigs.

It is only when we realise the idea I have tried to express that we begin to understand the permanency and magnitude of the apple industry, for the development of which much of Western Australia is

Pre-eminently Fitted.

There are, however, difficulties to be overcome and dangers to be avoided, and it is perhaps possible one may be able to offer suggestions which may in some degree assist. There are apples, and there are first-class apples. There is land, any quantity of it, where apple trees will grow (sometimes too freely), and produce fruit for home use or for sale within the district, where it would be foolish to plant orchards to produce apples for distant markets, or to compete against growers in more suitable localities. There are soil conditions where apple trees will grow and yield well for a few years, after which they become stunted and die out, whereas in other places the apple tree will thrive and produce fine fruit for a generation or two.

Points to be Considered.

The intending apple-grower, if he desires to be successful, must, among other things, consider the following points:—He must select a spot where the climatic conditions are favourable for the production of high-class fruit of good packing and keeping qualities, and fortunately there is no difficulty in securing these conditions in Western Australia. In considering the climatic conditions favourable to the apple, comparisons and references will assist us perhaps more than direct description. While the apple has a wide range of habitat, its most congenial home is a cool to cold temperate climate, such as England, Germany, France, the Northern and Eastern and North Pacific States of America, and Southern and Eastern Canada. Northern France has a mild temperate climate, and so has Devonshire, which is famed for its apple orchards, but occasionally there are heavy falls of snow, and every winter considerable frost. In the American apple belt the winters are severe.

Conditions in the East.

Coming to Australasia, Tasmania is by far the largest producer, and is considered to bear the palm for her apples. There the summers are warm, genial and mild, but the nights are cool, and the winters are cold enough for occasional snow and considerable frost. In Victoria the apple lands are in the hills or south of the Great Divide, where the nights are cold and frosts common in winter. In South Australia the apple grows as it does in Victoria, and in this State, over a wide range of conditions; but what may be called the apple country is all either in the south-east or in the hills, where the nights are cool or cold and frosts are common in the winter. One might say with regard to South Australia, the colder the climate the better the apples.

The South-West.

Applying the above principles to Western Australia, and checking them by the experience gained, we find that the conditions most suitable for the apple are to be found in the south-western corner of the State, and, going from the general to the particular,

and judging from what I have seen, such places as Mount Barker, Bridgetown, the Warren, etc., are almost ideal apple country. Katanning, with its elevation of 1,100ft., the Williams and Arthur Rivers, the Darling Ranges, also grow good apples. In addition, there are tens of thousands of acres which are suited for summer apples, but I consider that the first-named districts will, in the future, prove to be the apple belt of Western Australia.

Pruning.

The intending grower must grow only the best sorts, not only the actual best, but those which best suit the locality. There is sufficient local experience now to enable the intending planter to avoid making serious mistakes in this respect. He must decide whether he will allow his trees to grow as their nature inclines them, only interfering as necessity arises, of course attending to cultivation and the control of pests and diseases, or he must adopt an artificial method of pruning, study it, and thoroughly understand it, and make the trees conform to it. I think I am right in saying that up to now the most profitable orchards in Western Australia have been those where the least effort has been made in connection with forming and pruning the trees. I have been and probably am the most vigorous advocate for an entirely artifically-trained tree in Australia; but I believe it is better to let the trees comparatively alone rather than to spoil them by injudicious and unskilled pruning. My advice to growers is emphatically either absolutely control your tree, or after the first year touch it as little as possible. To absolutely control a tree requires full knowledge of the habit of growth and considerable experience of local conditions.

Misdirected Effort.

I regret to say that I have seen a number of young orchards which will disappoint their owners and prove very troublesome to care for, because the owers have pruned too much and have failed to grasp the essential factors for securing the object sought. The object of growing apple trees is to get apples, good apples, and plenty of them; but the trees I refer to cannot for years be as profitable as they should, and all because their owners, with commendable progressiveness, have tried to do what they did not understand. They are growing firewood, or rather faggots, and I reckon there is no absolute need to do that in Western Australia. In going round from district to district, and noting more or less pronounced examples of misdirected effort, I have thought that a great opportunity has been missed by the Department of Agriculture in not providing demonstration type trees in every centre where the fruit-growing industry was being established.

Practical Demonstration.

I would suggest a plan somewhat as follows:—

Growers in a district might be invited to place a few young trees at the disposal of the horticultural experts for demonstration

purposes. As I am not speaking of experiments which might prove failures, but of actual work on well known lines, there would be no difficulty in securing the trees. The demonstrator would then let it be known that he would show how to prune the trees at a given time, and those interested would gather together, and he would take, say, three or six trees of each variety and prune them, explaining the principles as he went on. These trees would be marked, and he would announce that he would take charge of the pruning for a series of years, and show, both in summer and winter, how to treat them. It would necessitate at least two, and sometimes three or four, visits in the year, but, each one being announced, would enable him to meet growers and give them practical instruction. The result would be that he would have a series of examples of trees in all stages of formation, which would serve as illustrations for beginners to copy. People could see the superiority of his methods by the results in form, profitable bearing, and facilities for working, and, after a time, he would be able to show results, and would not be met at every hand with the objection that his teaching was merely theoretical, as occasional demonstrators are in the Eastern States.

Looking Ahead.

It is quite impossible for the beginner to see ahead and grasp the meaning and object of the earlier steps in training a tree, whereas the man of experience knows positively what results will follow from his work. When he starts on a young tree, he has in his mind's eye that tree as he intends it to be after ten years of growth. I speak from experience when, in the most emphatic way, I say that the only possible way to teach the people is by demonstration right in their midst. I will also, with equal emphasis, say that if the Government will provide the demonstrator, the people of each district should provide the facilities; and I have never found growers backward in heartily co-operating in any progressive movement rightly directed; but they have no use for men who fail to secure their confidence. Indeed, everything depends on the confidence they have in the personnel of the demonstrators.

While travelling around I have, where asked to do so, given short demonstrations in a considerable number of orchards, but have found that the grower is not able, and in the nature of things cannot be expected to be able, to see far enough into the future to fully understand the ultimate object of a given course of action. This is why it is so necessary that the demonstrations should be carried on from year to year on the same trees.

Instruction and Inspection.

I understand that the horticultural expert does give occasional demonstrations, when time will permit, or when he is invited to do so; but I would respectfully suggest that in the interests of the important fruit industry, it would be better to relieve him of office work in order that he might be able to devote himself to the more

important field work. I also would suggest that an effort should be made to secure assistants capable of co-operating in this work, and that they should combine instruction with the duties of inspection of orchards under the pests and diseases regulations. In many cases owners either do not desire or require advice, and then the visits would be confined to inspection. As I said before, everything depends on the personality of the officer and the confidence he can command. In some districts certain progressive growers provide object lessons in fruit culture to all their neighbours. Perhaps the most noteworthy example of this which came under my notice was the splendidly-kept orchard of Mr. F. H. Piesse, M.L.A., at Katanning, whose son, Mr. Harold Piesse, a graduate of the Hawkesbury Agricultural College, is training his young apple trees splendidly.

The One Thing Needful.

I cannot emphasise the need for this recommendation more forcibly than by saying that in one instance the owner showed me with pride a block of four to six year old apple trees saying, "I have trained them and summer-pruned them according to your articles and advice in the *Garden and Field*." I replied, "For goodness' sake don't tell anyone else that." He had missed just one point, but that was the essential one—that to get a crop you must have plenty of bearing wood, and to steady a tree into early bearing you must distribute its vigour over as large a space as possible. The result was that this man's trees were pretty to look on, because of their regular shape, but as fruit-bearers rank failures. Here was a live, intelligent, progressive man, sparing no pains, being beaten on the profit-making side by a neighbour who did not prune at all, and whose trees, like Topsy, had just "growed."

Selection of Varieties.

In selecting varieties for planting, the grower has to consider the local market first, because it will be for many years a larger factor in apple-growing here than it is in the East, where large export surpluses have been produced for years. At the same time, the export market must be provided for, so that the grower will have "two strings to his bow." There are three factors to be kept in mind in selecting varieties, and several great dangers to be avoided. In connection with the latter, possibly the first caution is to beware of the plausible fruit-tree traveller representing firms far away. His business is to stick you for an order; yours is to grow apples at a profit, and the one does not always follow the other. I do not like grandmotherly coddling on the part of a Government; but I really think that there is no better work to be done by the Department of Agriculture than to protect honest nurserymen and confiding inexperienced growers against the fraudulent fellows who will put any required name on a tree to suit the immediate purpose of selling it. The task is not easy; if it were there would be no need to undertake it, for anyone can do easy things.

Quality and Colour.

Other dangers to be avoided are planting too many varieties. One hundred cases of one good sort are much preferable to ten each of ten varieties. Then the wiser grower will consider quality as well as appearance. It is quite true that at present, with the majority of people, the rosy cheek has as much to do in securing buyers of apples as it has in attracting attention to a face beneath a sun-bonnet. Rosy cheeks and good qualities are to be found together in the one case as in the other, and then no one will deny the value of the kiss of sunshine fixed by a frosty evening on the Jonathan or Rome Beauty; but if, as in the case of the Hoover, gorgeous colouring covers a poor fruit, leave it alone, for the public will learn the various apples in time and demand quality as well as looks. I find that a comparatively worthless Hoover will, at present bring to the grower nearly 50 per cent. more than that queen of apples the rich yellow juicy Cleopatra. It won't do so for ever. In London, for ten years past, the Cleopatra has realised a higher average price than any rosy-cheeked apple, and, in time, it will be appreciated here.

At present it is not. The people want colour, and what the buyer wants the seller is wise to provide; and it is, therefore, desirable to select those varieties which combine high quality with colour. Of such, the Jonathan comes first, and nowhere have I seen this apple prettier, finer, or of better quality than in Western Australia, and it is as suitable for the London market as for Perth or the goldfields. Among other rosy varieties of the first quality are the Scarlet Nonpareil, Adam's Permain, Cox's Orange Pippin, Ben Davis, Esopus Spitzenberg, and last, but not least, the Rome Beauty. All these are of good quality, have been sent to London on an extensive scale, realising high prices, and they sell well here.

The Pale Varieties.

Of the pale varieties, those which have done best in London are the Cleopatra, Dunn's Seedling (called in Victoria Munro's Favourite), London Pippin, and Stone Pippin. The Sturmer Pippin is one of the standard sorts in Tasmania; but those I have seen here have lacked the quality of the Tasmanian Sturmer. At Mr. A. Doust's, Bridgetown, I saw an apple of very fine quality which was new to me; he called it the Chandler, and says he got it from Victoria. I recognised the tree under another name in another orchard doing equally as well. The tree is an upright grower, a heavy cropper, and the apples seem to be of first quality, and red enough to sell. It should come in with the Rome Beauty, I think, and is well worth watching.

In conclusion, I have no hesitation in saying that the general appearance of the apple orchards in Western Australia, keeping in view the healthiness of the trees, even from disease, cultivation of the land, bearing qualities, and quality of the fruit, will compare

favourably with those of similar age in any of the Eastern States, except Tasmania, where the splendid artificial system of training the trees renders comparison in that matter impossible.

MISCELLANEOUS FRUITS.

The Pear.

Practically most of what I have written about the apple will apply to the pear, and it is not necessary to go over the subject again. The State is eminently fitted for pear culture, but it is necessary to remember that while it is easy enough to grow pears, it requires a deal of knowledge and experience in gathering, maturing, and marketing the fruit when grown. Some varieties, such as the Williams Bon Chretien (or Bartlett), which is the queen of pears, Keiff's Hybrid, and Vicar of Winkfield, can be handled by anyone, but many of the choicest varieties require to be gathered just at the right time, and properly stored under varying conditions in suitable fruit houses. Except for such sorts as I have mentioned, pear-growing should be made a speciality by the experienced orchardist only.

Japanese Plums.

These, I find, do remarkably well here over a considerable range of soil and climatic conditions, as some of the varieties, such as Wickson, Burbank, Abundance, Satsuma (blood plum), and General Saigo, are prolific bearers of very fine fruit of beautiful quality alike for dessert as for cooking. I feel sure that the Japanese varieties of plums will, in the future, form a special feature in the Western Australian fruit trade. I feel confident that in a few years a profitable trade will be done in England with some of these plums, as they are not only of fine quality and attractive appearance, but carry remarkably well.

CLEARING THE LAND.

The question of the cost of clearing land is one of the stumbling blocks to the intending settler. I had heard much about it before I came, and therefore paid considerable attention to the subject. Having made many inquiries, I find some difficulty in bringing the replies into harmony with one another. Both before I came, and while visiting the agricultural areas, I have heard many severe criticisms on the lack of information, or what has been termed misleading statements in the publications issued by the Government. In referring to this matter, I do so not as a critic, but in order that, if necessary, it may be remedied as opportunity offers.

For example, on page 9 of the *Selectors' Guide*, in referring to Mount Barker district and its undoubted suitability for apple growing, it is stated that the cost of clearing ranges from £3 to £6 an acre. I am not in a position to question whether or not there be apple lands which can be cleared for the amount named; probably there are, but I did not see them. I drove through a great extent of splendid apple-growing country, and I do not think that it would be fair to lead anyone to believe that it could be cleared under £10 or £12 an acre, and even then it would have to be gone about in a systematic way. The country is good, and I believe that in time to come it will prove one of the best apple districts of Australia, but it is heavily timbered, and will be expensive to clear.

On page 26, the cost of clearing in the Preston Valley, for potatoes and other root crops and for orchards, is given at from £3 to £6 an acre, and I recall the emphatic rough way in which a South Australian, who came over here to look for orchard land, spoke of the compiler of the book. I will repeat his remarks in order to show how much harm may be done by lack of complete candour. He said: "The writer was either a liar or a fool, and in either case I don't want to deal with those who employ him." This man had happened to fall in the way of a settler who had tried in vain to burn, split, or otherwise remove blackbutt trees from a rich flat, and finally disposed of them by burying them. That, of course, is quite an exceptional case, for blackbutt is uncommon except on the rich river flats of the Blackwood and similar districts. One cannot help concluding that it is neither right nor wise to give people at a distance the idea that the heavily timbered lands which form much of the best dairy, orchard, vineyard, and garden country, can be cleared at the prices named.

In support of the *Selectors' Guide*, however, I may mention that Mr. E. Rose, of Brunswick, near Bunbury, has recently had 300 acres of good red gum land on hill sides cleared, and he told me that the average cost was £4 16s. per acre. On the other hand, Mr. E. McLarty, M.L.C., of Pinjarrah, showed me a magnificent flat on the banks of the Murray River which cost £8 an acre to clear, after the country had been ring-barked for years and the undergrowth cleared, and a number of big trees still remained, so that the probable total cost would approach £12, although he took time over it, which the new settler could hardly do. I think that the cost of clearing some of the best patches in the South-West is quite £25 an acre.

It is but fair to say that while the cost of clearing the red-gum, jarrah, and blackbutt land is under-estimated, the only reference to the subject in connection with the wheat areas is an over-estimate. On page 22 the cost of clearing at Katanning is given at from 30s. to 60s. an acre. From many inquiries at Katanning, Wagin, and Narrogin, I think that I am right in saying that the cost of clearing in the approved fashion by ring-barking, cutting down small stuff, and burning off under the general conditions of the York gum,

salmon gum, white gum, flooded gum, and jam country, need seldom exceed 30s. an acre, and under judicious management by old settlers is done at from 17s. 6d. to 25s., according to the conditions. A new settler should, however, base calculations on 30s. an acre. The developments in the methods of clearing which have taken place during the last few years, whereby the cost has been greatly reduced, proved very interesting to me.

As the settler goes farther north the cost of clearing becomes less, for in the Northampton district the chief timber is the acacia known as "raspberry jam," and another acacia or wattle. These can be got rid of for less than £1 an acre by systematic work, but there is a yearly expense in cutting out the seedlings which readily spring up for years. This remark applies to a greater or less extent over large areas of the better country. I think the best treatment will prove to be the summer fallow. It should be here noted that in the northern wheat section, where the timber and scrub is small, the system of "mullenising," *i.e.*, cutting all growth off level with the surface of the ground, and then cultivating with stump-jumper implements, is found to give satisfactory results, and then the cost is reduced to a few shillings an acre.

THE EXPERIMENTAL PLOTS.

In accordance with the request of the Minister for Lands, I paid a visit to the Hamel district, 71 miles south of Perth and some 106 feet above sea level. I was accompanied by Mr. Alex. Crawford, Acting Director of Agriculture, who first conducted me over the experimental plots of the Department of Agriculture, where Mr. G. F. Berthoud, in addition to conducting the experimental work of the department, is exercising his love for horticulture and the raising of new varieties of plants in a remarkably successful way.

Seedling Potatoes.

I was struck with the successful results being obtained in a plot of new cross-bred potatoes. It is a recognised fact that as the potato is propagated by tubers or cut tubers which are really subdivisions of the parent plant, they invariable degenerate under commercial conditions, and a given variety can only be maintained in quality by a careful continuous selection of sets and change of locality. This the commercial grower does not and cannot very well carry out. To obtain new and improved varieties to replace the degenerating ones, cross-breeding and raising from seed is absolutely necessary, and the work is now attracting considerable attention in Britain, Germany, and elsewhere. It is too soon to judge the value of Mr. Berthoud's varieties, but the growth of the first crops is most promising.

Maize.

The experimental plots of maize show fair growth and some really fine cobs of corn. Several experiments in crossing are encouraging.

Grasses.

Among the most useful of the experiments—if indeed they are not the most useful at present—are the grass tests, of which there are a number to be seen. The plan of work seems excellent. In Mr. Berthoud's somewhat irregular ground grasses are planted here and there, and those which offer encouraging results are then grown in larger plots on departmental ground under more trying conditions. Those which promise best under these conditions may (and I am given to understand that it is so intended) then be sown or planted under commercial conditions to finally test their suitability to the soil and climate.

Fodder Plants.

I consider the question of the growth of fodder plants (grasses and others) to be the most important work in connection with the Southern and South-Western districts. With the vast areas of cereal country in the Eastern, Southern, Midland, and Victoria districts, I do not see that the South-Western districts can compete in the growth of wheat, hay, etc., but they have other and special advantages, and the growth of fodder crops is one of the most important.

For the above reason, I am of opinion that it is not making the most of available money and effort to carry on experimental work in cereal growing here; but I would not restrict an enthusiast like Mr. Berthoud in his work of cross-breeding. Few men have the aptitude and patience of that gentleman, and he may at any moment produce a variety worth scores of thousands of pounds to this State. Let him by all means raise his new varieties and fix the types, and then let the work of testing them be carried on at such stations as the Chapman Farm and Narrogin Experimental Station.

Cotton.

This product looms large in the world's agricultural and industrial eye at present, and in passing it may be noted that Mr. Berthoud has grown the plant successfully. I do not, however, understand cotton-growing from personal experience, and as I desire any opinions I may venture to express to have value, I refrain from saying more than that, judging by what I have seen of the cotton crop of Egypt, I think a little money spent in experiments with a view of testing the suitability of parts of Western Australia for cotton-growing would be a legitimate outlay of State funds.

The State Nursery.

From the experimental grounds I was taken to the State Nursery, under Mr. McFarlane, whose help in understanding some the problems of the soil of the locality I beg to hereby acknowledge.

The area devoted to the nursery and plantation is only 17 acres, so that much cannot be done in the way of forestry. The block of *Pinus insignis* is instructive, for on a poor sandhill the trees have made splendid growth, and in 20 years from planting, I believe, will prove very profitable, if our experience in South Australia is any guide. I planted trees of this variety in 1884, and they are now from 60ft. io 75ft. high, and up to or over 2ft. in diameter, axe high. The South Australian Forestry Department has proved the practical value of such trees for timber for fruit cases.

Small lots of Queensland cedars, on the richer lands on the banks of the brook, have made remarkable growth, and the growth of a few South Australian Golden Wattles (*Acacia Pyenantha*) and Tasmanian Silver Wattles (*Acacia Dealabeta*), near the house on the sandhill, is greater for the age than could be secured in South Australia. These are, perhaps, the two best bark producers, but I cannot say what the quality of the bark here would prove to be.

The nursery stuff is remarkably clean, healthy, and well-grown, and is, I am informed, chiefly used for the planting of school and other public grounds, and for planting as shade trees on the goldfields. The varieties chiefly grown are, I think, thoroughly suited for the purpose, and comprise S.A. Sugar Gums, Peppers, Silver Wattles. Golden Wattles, *Acacia Baileyana*, Currajongs, Pines, Cedars, etc.

Prison Labour for Clearing.

I would like to be permitted to say that I think that the plan of utilising the well-behaved prisoners for clearing the land for use as experimental plots is one of the most praiseworthy solutions of a difficult problem which has come under my notice anywhere.

TEOSINTE

(Euchlæna Mexicana).

This plant is a native of Southern Mexico. It is highly commendable as a fodder grass for those districts free from frost. A large number of stems, sometimes as many as 90, spring from the same root, and attain a height of 18 feet. The leaves, which grow to about three feet long, form good forage. It becomes tough and hard if allowed to stand, but is good for ensilage. The young shoots are sometimes boiled and used as a vegetable. The illustration is from a photograph of a plant grown at the experimental plots at Hamel. It has been grown in various parts of Australasia. It is much quicker in growth than guinea grass, though slower than maize, but lasting longer as green fodder, and not quite so hardy as sorghum. Its growth can be continued by repeated cuttings. It likes humid soil best, and resists intense heat.

TEOSINTE (*Euchlæna Mexicana*).

THE HORSE INDUSTRY IN AUSTRALIA.

By W. G. McKinney, Melbourne (Vict.), Live Stock and Agricultural Contributor to the *Australasian*, *Argus* (Melbourne), *Town and Country Journal* (Sydney), and *Chronicle* (Adelaide).

General.

Horse breeding has been described by an English writer on the subject as "A National Question," and in the course of his remarks on the subject he refers to the importance of the production of this class of animal as an addition to agricultural employments. What he says on the point need not be quoted here, because the remarks have relation to the matter from an English aspect, and are, therefore, not accurately applicable to Australian conditions; but the argument put forward that the raising of good horses in a proper manner is a sufficiently important question to be fairly described as a national one, and I may supplement that remark by another, to the effect that if it be true as regards the old country, with its comparatively restricted area and severe climatic conditions—and none can doubt it—it is doubly and trebly true in Australia, a country that appears to have been specially designed by Nature for stock-breeding, natural food being abundant, while the genial weather which prevails nearly all the year round and the vast territories available as runs for depasturing animals, point conclusively to the fact that to neglect such manifest advantages as these is to slight one of the good gifts of Providence.

Absence of System in Breeding.

It cannot be said with any degree of truth that horse breeding has yet become a really settled industry in Australia, all the enterprise in this direction having been of an intermittent character. That is to say, there has been a failure, so far, to regard it as a "national question," and an entire absence of systematic operations all over the continent, from which have sprung an Australian type of horse, an animal to make a name for itself abroad, and command the attention of world buyers, as the English thoroughbred, the Scotch draught, the Irish hunter, the Shetland pony, and, last but not least, the American trotter have done. We have been "pottering" along as horse breeders in the several States for periods varying from 20 and 30 up to a 100 years or thereabouts, according to the length of time the various parts of Australia have been settled, and we have, with all our natural advantages, all the inherent virtues of the country as a producer of some distinctive class of horse, still kept upon the border line of this great industry in respect to the thoroughness of our operations, with the result that we are now hardly able to meet our own wants in the way of horseflesh, and totally unable to get together anything like fairly

large supplies of good specimens for export purposes. This statement is not made in ignorance of the fact that "The Australian Horse" made a great name for itself in the South African war as a creature of stamina and suitability for work of this kind, or of the fact that at the time referred to we did, as a country, send away many thousands of really good animals to the seat of operations, and have for many years past sent regular consignments of specially-picked horses to India, there to be used as remounts, racers, and carriage animals. People familiar with the subject know all about what has been done in the past, but, to alter the words of the poet somewhat I may say—"What's done you partly can compute, but you know not what might have been done in other directions," had the farmers and other land owners of Australia been more faithful to the industry and paid heed to it to the extent it deserved. Granting all that has been done, it must still be urged that we have established no type, and the reputation the Australian horse has made abroad so far is, instead of being something to our credit, rather a reflection upon us, because it demonstrates our folly in neglecting such magnificent natural advantages as we enjoyed. Our horses have become famed in places where they have been introduced, and that in spite of our want of method in the work of breeding and the absence of any effort to establish a type; they possess much inherent virtue, which would, if developed, make a world-wide reputation. The trouble has been, we have done no developmental work. Rather have we—that is we as a people, rather than as individual breeders, many of whom have done splendid work for years past—bred without giving the matter due consideration and practically without knowledge of the subject. The present intention is not to discuss this question exhaustively, but rather to give a brief dissertation on the matter with a view first to find out what faults we have been guilty of hereanent in the past and what should be done in the future to rectify existing evils.

Slip-shod Breeding.

It has already been stated in general terms that we have failed as systematic horse-breeders in the years that have gone. The point is—How have we failed? This question is easily answered. We have failed, because we have not taken horses seriously. We could not eat their flesh, or shear them for wool, or milk them for butter and cheese; and, forgetful of the usefulness of the animal in divers different ways, the farmers and others have been rather inclined to either neglect the production of them altogether, or, if they decided to raise a few foals, do so in a slip-shod manner, breeding from any kinds of parents and treating the progeny in any kind of way that came handy. No study has been given by this class of breeder, so-called, to the mere rudiments of the art of mating, no attention was devoted to the selection of the mares set apart for stud purposes; and, worst of all, many of these mares so devoted have been ill-fed and over-worked during gestation, utterly regardless of the fact that irreparable injury was being done to the unborn foal. I have in my mind, while writing, one specific

case of a horse-breeder who thought any mare was good enough to throw a foal, and who failed as a consequence of his folly, both as a breeder and in a financial sense. He imported from America one of the handsomest trotters that had up to that time (20 years ago) been introduced from that country. The horse was in every way eminently suited for the duty of improving our carriage horse stock, and he would undoubtedly have done so had he been treated fairly. The owner, however, became imbued with the idea that a foal had only one parent, or, at least, that the male was the only one worthy of consideration, and when he was stocking up his breeding farm for the incoming season he asked me, as a horse salesman, to help him with his task, fixing his price limit for the mares at £2 10s. a head. Horse flesh was certainly cheap at the time, and the £2 10s. figure then was equivalent to what £5 or £6 would be now, but was it not utterly ridiculous, nay, suicidal, to fix such a limit for mares to be mated with a sire worth about £1,000 or over? Certainly it was, and no one who knew anything of the subject of breeding felt any surprise when in after years it was found that this magnificent stallion left no name behind him, although, had he been properly treated, there would probably be many worthy representatives of the strain of blood about at the present day. This breeder was ignorant. He did not know that the mare's influence on the foal is two-thirds of the total and that the horse exercises but one-third of the sway. He fancied, and thousands in Australia have the same idea, that "any mare is good enough to breed from," whether she be spavined or curby, poor in constitution, bad in bone, weak in build, of evil temper, or the whole lot together, and that a first-class sire can get first-class stock, however mated. The above recital will probably be excused by the reader who opens this pamphlet for information rather than an anecdote, when it is said that the folly described is a common one in Australia, and when it is pointed out that the case illustrates what I wish to specially emphasise, namely—1st., That a foal has *Two Parents*; and 2nd., That the more important one is *the Dam*. Hence more attention must be paid to the latter than has been in the past, for she must be sound if sound stock are to be the result; of good constitution, if the progeny are to be worth raising; in good health, if the foal is to be the same; and treated properly while at the stud, because if a foal be starved from the very beginning of its existence, and comes into the world a weakened starveling, there to suck a mother whose natural supplies have been absorbed by over-exertion under the saddle or between the shafts, it seldom makes up the bad start it gets and runs a losing race all its life.

Class of Country for Horses.

There is hardly any part of settled Australia where horses cannot be raised. They thrive in cold as well as in hot countries; they do well on gently-undulating country as well as among the hills and on the flats; they will grow satisfactory if fed upon the rough grasses of the broad tracts of the inland, upon the softer

and finer herbage of the more humid parts, and in even the districts where feed is so spare that horned stock cannot thrive. They can nip more closely than a bullock, and are more active in the search for food. In short, horses are citizens of Australia, so to speak, and almost any part of the country is their native home; but, cosmopolitan though they are in their tastes and habits, they have a decided preference for good conditions of life, and show the marks of their surroundings more noticeably than any other animals. In other words, a poor and unsuitable district will produce poor and unsatisfactory horses; and the better the locality is the better are the animals raised in it. The downs country of Queensland and New South Wales produce horses that are different in character to those raised in the coastal regions; the hill-bred horse is different to the one grown on the flat; and though all may be good in their way, they have different characteristics and qualities, which brings us to the question as to what class of country is best adapted for the purposes of a stud farm. The matter of climate need hardly be discussed in this connection, for that of any part of the continent is good enough. The question of locality, as it relates to the soil and grass produced, is of much more importance, for a horse is very much what he eats. Indeed, it is contended by the best breeders that pedigree ranks next to feed in the matter of raising animals with substance, and that while it is possible to grow a good horse from inferior parents, it is not possible to have a sound-constitutioned animal if fed upon food that does not possess the bone-making and health-giving elements that are required. The best boned horses come from country that has plenty of lime in the soil, for bone is lime, and grass grown upon lime-impregnated soil conveys that element to the bone substance, per medium of the digestive organs. Very large areas of Australian country are rich in lime, therefore a considerable proportion of the continent is in this respect adapted for this class of industry. The surest-footed horses and those with the best hoofs are those bred and depastured during their earlier years in stony paddocks, where the surface is hilly. This stands to reason. In the first place, stony land mostly contains a large amount of iron, which has a beneficial effect upon the constitution generally, and directly upon the legs and hoofs. Again, the fact that a foal in such country has to pick its way among loose and stationary rocks gives it an alertness in avoiding obstacles and teaches it to keep its eyes open to avoid stumbling. Such foals acquire a cleanness of action that is not derived from land devoid of stones, and they also become cunning in the matter of recovering themselves should they make a false step, while the unevenness of the country itself, the up-hill and down-dale travelling serves to develop the muscles of the loins as well as those of the legs and other parts of the body. The best place to breed horses, other conditions being favourable, is hilly and stony country. Horses bred in marshy ground usually have very large, flat hoofs; and that is a fault, more especially if the substance of the feet be soft, as it very often is in these circumstances. Horses bred on flat, though dry and otherwise suit-

able country, lack the foot cleverness of the hill-bred beasts, without which a saddle hack or gig horse can not be classed as safe.

Natural Shelter for Horses.

One desirable feature about a horse paddock is natural shelter—that is, the shelter of growing trees—for not only do they afford protection from sunshine, rain, and cold winds, but they impart a healthfulness to the locality as well, combined with the advantage to be gleaned from bushy growth, which, when low down to the ground, are a great assistance to the animals in "fly time." Warmth in winter and shade in summer are almost of as much importance in keeping up condition as food. An insufficiently-fed colt in a comfortable paddock will invariably thrive better than a fully supplied one in a bleak or sun-parched spot. If stock-raisers would but recognise this fact, and plant trees where they do not grow naturally, they would save pounds sterling in "the feed bill," and the outlay in setting out the trees would be abundantly returned to them.

Small Paddocks.

The breeder, then, should see to it that his mares are fit for the duty of reproduction, and have a nicely-undulating stony paddock with suitable shelter. But more than this is required, although these are among the most essential parts in the mosaic of success. Small paddocks are better than large ones, because horses are apt to grow wild when allowed to roam far and wide. When more confined and allowed to become familiar with human beings, they suffer less in breaking than if unused to forms other than those of their field mates. It is better to start a colt's education in a modified degree when it is very young than to wait till the roping time arrives. Use is second nature, and if used to man from its earliest days it can be broken more cheaply, more thoroughly, and with less damage to the animal itself. Plenty of water is another essential to the properly-equipped horse farm, a running stream for choice, as the liquid is likely to be purer than when it is in stagnant dams or surface tanks. However, so long as it is free from taint it will do, if always accessible, for though a horse does not drink frequently during the day, even in the heat of summer, he will fret and refuse to eat if he wants a drink, and while fretting he is losing condition. When horses have to be driven to water daily they suffer considerable set back, more particularly if they be growing foals, for these are apt to become over thirsty while waiting for the stockman, and to overgorge themselves with water as a consequence.

Treatment of Foals.

The first week of a foal's life is the most risky period, for at that time the creature has not yet "got the hang of things" to any extent, and it is so stupid that it will stumble into danger with perfect unconcern. Furthermore, certain physical changes have taken place during its transition from the fœtal stage to that of the

mundane animal, some of the functions hitherto active having become dormant, while others have just come into operation. The details need not here be gone into; the fact may be stated in general terms only, that the first few days represent the critical period, and it is then that special care must be taken to minimise trouble as much as possible. Practical knowledge is required to enable those in charge of this department to treat complications that often do arise, resulting in swellings in various places, sometimes breaking out as suppurating sores. Cases can easily be treated when they occur, but the better plan is to avoid their occurrence as much as possible by providing a clean yard or small paddock for the period referred to, for many of the troubles to the foals are caused by germs from stable manure, etc., attacking the youngster in the first few hours of its existence. Later on, when the foal commences to nibble, care should be taken that it cannot pick up bedding or other rubbish, for such produces constipation, which, if neglected, may produce fatal results very quickly. The ordinary precautions only are required in connection with this matter, but, if neglected, the cost of such is usually very heavy.

The Growing Colt.

Little need be said as to the treatment of the growing colt after it has got through its infantile perils and commenced to eat grass. It may, however, be repeated that the best fed colt has the best and soundest constitution as a rule; therefore if a good one is desired good nutritious food, with access to salt and plenty of water, as well as good exercising space over stony, undulating country for choice, must be provided, for these make up the sum and substance of that highly desirable animal—a sound, good horse. Breed well and feed well, and you will ride pleasantly and drive pleasantly; produce from mongrel mares and starve your foals when they do arrive and you will fill the land with runts that will never yield enough money at four years old to pay for the grass they have eaten and never be anything but a source of dissatisfaction to the person who tries to work them.

Importance of the Sire.

The great aim of the horse-breeder is to reach as near to perfection as possible. He knows he cannot gather figs from thistles, and that, similarly, he cannot reap a harvest of sound colts from unsound parents. Although the mare's influence is two-thirds or more of the total exercised by sire and dam, the male parent's importance must not be overlooked. The reason I have dwelt upon the mare's share of the responsibility so emphatically is to impress those—and they are legion—who deem her of comparatively little account in this matter. At the same time we must never forget that the sire is a potent factor for good or ill. This being so, it is all the more regrettable that so many wholly unsuitable horses have been allowed to remain at the stud. It is not to be inferred from this that they are unsuitable as a rule because of

apparent bone or other constitutional troubles, for very seldom do we find at stud a palpably unsound stallion, and this for the simple reason that breeders would not employ them, more especially seeing that they, as a rule, attach so much more importance to the sire than the dam. They will rake out their broken-down, rotten-boned mares by the score and expect wonders in the way of a crop of sound foals; but the sire they pay for the services of must be free from visible blemish; and he is free as a general thing; but there are other than visible blemishes. There is the leg bone that is perfectly free from blemish, but of such a quality that if the animal were not pampered night and day, never allowed to travel faster than a walk, and practically wrapped in wadding all his life, he would soon show any number of osseous growths, which lie dormant in the structure and are passed on to the unfortunate progeny. The wadding-wrapped horse does not hide his deformities for many years "however watched and tended"; they manifest themselves in spavins and ring bones, curbs and general break-down of the legs after perhaps half-a-dozen years at the stud, and during that time he has had the opportunity of afflicting 400 or more youngsters with his weakness and inflicting an enormous injury to the horse-breeding industry. It is the invisible troubles that are the danger so far as the sire is concerned, and although his influence for good or evil is less than is that of the dam, the aggregate trouble he causes is a hundred times greater, because his family is necessarily larger. The unsound mare can afflict but half-a-dozen offspring in a breeding lifetime as a general thing; a sire damages by his influence the usefulness of hundreds. Apart from specific diseases or weaknesses there are many other matters to be considered in the selection of a sire. The agricultural shows that are by now an established Australian institution of great usefulness give the breeder much help in this regard, for through their means the judging for quality is done, affording a guide to those who are not experts, albeit the system of judging now in vogue in most parts of the continent is far from perfect, yielding as it does much less enlightenment than it should. We need not discuss the show judging question here; it is good and bad according to circumstances, and, like the little girl of the doggerel verse, "When it is good it is very, very good; but when it is bad it is horrid." The horridness of it consists in its misleading results. It is a positive harm to the industry when, by bad judging, a poor horse gets a first prize, for to accord him this honour seems to denote a certain worthiness; and when breeders follow the indication of the blue card of merit improperly bestowed they are victims of a bad state of things, and have cause for complaint; but to get back to the sire—what the breeder wants in his foals is as much concentrated quality as possible, and what he must demand in the sire is something as near to perfection as he can get.

Points all Horses must possess.

Although there are many breeds or horses, each being designed for the performance of distinctly different kinds of work, there are

certain essentials common to the lot. The pony, the thoroughbred, the trotter, and the draught must all possess soundness of bone and constitution, legs set at about the same angles to the body, barrels properly knit at couplings or loins, strength of thighs, good muscular developments in the arms, plenty of chestroom for the lungs to work in, intelligent head and tail set nicely on the back end. These and many other points are common to all kinds of horses, and to judge every animal from the artistic standpoint is a pretty safe thing to do, for the artist will favour symmetry and grace and beauty and thus agree with the horse judge who requires what he calls "balance" combined with well-developed quarters, which, besides being useful, are also pleasing to the eye. In actual knowledge the painter, sculptor, or ordinary person with no training in any of the arts, but possessing the artistic instinct, that is the eye for proportion or "balance" or evenness, or whatever else it may be called, yet he (or she) may, by following the natural taste, be able to form a very sound judgment of a horse. At the same time there is a class of horse, technically known as "the mug's horse," which is only good to look at, possessing but little value for work, because the substance and spirit, born of sound breeding, are absent. The artistic eye combined with knowledge, the result of study, are what makes a man a good horse judge; given either qualification he can form an estimate that may prove correct, but he wants both to be unerring.

Various Breeds of Horses.

Having dealt at moderate length, in general terms, with the horse family as a whole, we now come to the various breeds that are best known in Australia. There are several kinds familiar to European people that have not been introduced to Australia except in a limited and experimental way, these including what are called Flanders horses, Suffolk Punches, Shire Horses, Norman Percherons, and others. The last named class is a really magnificent animal, and the wonder is that is has not established itself in Australia. It is an active draught, standing on lengthy and solid legs, and walks with a sweeping stride that enables it to get over ground quickly. For lorry or general carrier's work the animal should be all a man could wish for, but the fact remains that it never took on in Australia, an effort made in the early eighties to introduce four magnificient stallions to Victoria having proved a great financial failure, the horses having been sold on arrival at very much less than they cost when bought in England. The Australian breeder has been loyal to the Clydesdale horse, the breed having been found best adapted to our requirements, and hardy. In regard to this breed it must be said that there has been a very considerable deterioration in the past quarter of a century in all the States where it has been bred. During the period the studs were somewhat neglected and weediness began to show itself. Few new sires were imported, comparatively speaking, and to add to the trouble many of the best draught mares were

bought up by New Zealand breeders who now occupy a much better position in this department of enterprise than any of the States of Australia. There has been a waking up in this connection during the past few years, but still a great deal of importing from Scotland requires to be done and the hope may here be expressed that such will take place in the early future. In the meantime New Zealand is sending to Australia numbers of magnificient specimens of the breed. The wants of this continent, however, are such that enterprising and all as New Zealand is she cannot hope to adequately meet all our wants.

Clydesdales.

In regard to the points of a Clydesdale stallion it may be said that while all judges are agreed as to the main characteristics required there is some diversity of opinion as to some of the features, and this diversity is growing in later years since there has been introduced to our shores from Scotland a class of horse known as "the new type Clydesdale," an animal possessing less leg hair than the earlier kind and more activity, combined with a higher and cleaner action in walking. There are judges who will have none of this new type and who contend loudly for the coarser bred horse. As to the merits of the dispute nothing need here be said farther than that both sorts have their virtues and both are worth breeding from—it all depends upon the coarseness or firmness of the females. Given a sufficiency of leg bone and weight of barrel, and proper muscular developments where needed, the finer bred horse will serve an excellent end in Australia, supplying as he will the farmers' wants in the matter of horses for harvest work and general farm purposes, and furnishing also saleable colts for city duties of various kinds. The old-time Clydesdale is too well known to require special comment, but in respect to this new fancy it is worthy of remark that it has come to Australia to stay, notwithstanding the antagonism of a good many of the older breeders; but in order that they may prove properly effective in establishing a sound class of animal, it will become necessary to select the mares carefully, and not use the horses in studs where the tendency of the dam is in the direction of weediness. There is abundant scope in all the States for a revival of the draught horse industry, and if the work be carried out on sound lines a good measure of satisfaction will result. The sires bred from must have substance and plenty of it, as well as weight, even though this be had accompanied by coarseness. Draughts are wanted for weight, and coarse horses are more apt to get good stock from the general run of weedily inclined Australian mares than are stallions too finely bred; and in the new type horse itself it would be a mistake to mistake fineness for quality and breed from a sire of this variety possessing no more bone than a coarse Cleveland. The bone and stamina must be maintained at all times, and this point is worth repeating more than once.

To Judge a Clydesdale.

A few words on Clydesdale horse judging at shows or on the farm will not be amiss here. A Press critic in this class at the Royal Agricultural Show, Melbourne, for the *Argus* and *Australasian* for several years past, I have been able to form my own conclusions as to the capabilities of some of the judges who have officiated there, and, while similarly engaged at country shows in light and heavy horse classes, I have also "judged the judges" for my own enlightenment as to their fitness for the task they have undertaken. In many instances they neglected some of the more important points, thus proving their want of thoroughness, to put it mildly, and in other cases they have awarded first prizes to unsound animals. In the Royal Show, a few years ago, three judges placed a two-year-old colt first, and, when their attention was called to the fact that he had a splint on each fore-leg, near to the back tendons, one of them candidly expressed his surprise, and said he had not noticed the blemish; but the award had been made. The method of estimating quality followed by the best judges is, first, to take a casual glance over all the horses in the ring, and then come down to individual cases, beginning at the near side with the fore-foot. The shape and substance of the hoof is carefully noted. The broad and ample foot counts a lot in the horse's favour, while a contracted foot is a distinct demerit, and calls for special comment and loss of marks. The reason the foot is taken first is that it is the basis of the whole question of value, for, if it be bad, the horse cannot be good. Close examination for side bones and ring bones follows the inspection of the hoof, and afterwards the cannon bone is felt from the knee to the fetlock. In this way only can splints or "gumminess" be detected on the hairy portion of the leg, or the quality of the back tendons be ascertained. The quality of the hair then passes in review. If it be coarse and curly, it indicates coarse breeding; if fine and straight, growing in good length from the back of the knee in increasing volume down to the hoof, that indicates clean breeding. The knee should be of good size and flat in front, and the forearm should be large and muscular. The near hind-leg is next examined, and, after disposing of the leg below the hock, the gaskin is inspected. There should be plenty of firmness here, and a good show of muscle on the inside portion of the thigh. The hocks should be clean and free from thickness or gumminess in front, and from caps behind, though the latter is not an important matter, being rather a blemish than a genuine fault. After having closely scrutinised the "groundwork" of the horse, so to speak, the judge goes over the top portion, commencing with the head, looking inside the mouth for shape of jaw and development of teeth. The forehead is judged for width, which indicates intelligence, and the eye is looked at for disposition, while the nose shape gives a hint in regard to courage, a pronounced nose being good. The ears should be large rather than small, and the throat roomy. The chest should keep the fore-legs well asunder, and it is at this point much admiration is bestowed when the horse presents a good broad view from a front position. The fore-legs should be straight, and

not dipping in at the knees, while a "cow-hocked" animal is as bad as a "calf-kneed" one. The shoulders are examined for slope, which, in a draught, should not be as pronounced as they are in the lighter breeds. The barrel and couplings next pass in review. The former must be short enough to present the idea of a "tower of strength," and the loins must be of such a shape as to suggest a modified arch, although too much of a curve upwards, making a "roach back," is a distinct fault. The rump should be round and well covered with muscle and flesh, and taper nicely down to the thigh and gaskin, lending grace to the back view. The examination over, the horse is walked and trotted to show his action and test the wind, and then the comparison of virtues and faults as between the various competitors is done. The task is a troublesome one when merits are close, and it should never be undertaken by a lazy or incompetent man.

Thoroughbreds.

The thoroughbred is the parent, in part, of all the best light horses bred in Australia, as he is the foundation of the English carriage horses and the American trotter. This breed is the basis of our hacks and harness horses, and to that extent it is worthy of respect. It also supplies the wherewithal to continue our system of racing, and in that respect he falls considerably in the estimation of the horse lover, for the worst use a man can put a horse to is to convert him into a gambling machine by asking him to flutter over a four furlong course with a boy on his back no heavier than a postage stamp. It is contended that horse-racing has improved the breed of our thoroughbreds. Perhaps; but in some cases only. Horses that can carry weight over long distances are a credit to their family; the four-furlong flutterers are a disgrace; but this is by the way. The influence of blood horses is too valuable to the country to be overlooked, and it may sincerely be hoped that the stock will not be allowed to deteriorate. It has done so in thousands of instances, and for this we have to blame short races and a short-sighted policy among breeders who thought any sire and any dam possessed of that charmed something called "pedigree" were good enough for reproductive purposes. The stamina of the stock must be kept up, and this can only be accomplished by the adoption of some system, the absence of which in the past is deplored earlier in the present article. Fresh thoroughbred importations from England are desirable; the present blood wants reviving with some outside infusion.

Trotters.

Trotters are harness horses, and as such the most useful of all light breeds. So far, comparatively little has been done in Australia to produce this kind of stock in anything like large volume. As in the case of Clydesdales, the New Zealand people have taken the lead in developing this branch of the equine family, and that country is now at the top of the tree with high-class trotters, as its thousand pounds trotting meeting at Christchurch

this year denotes. Victoria, hitherto backward, has commenced to wake up, and the formation of a Speedway Club in Melbourne by some of the leaders of the trotting fancy in that city, has done a great deal of good in stimulating public interest in this class of animal. What is wanted is a number of these clubs in the several cities, comprising the rural breeders of horses as well as the city men, for such organisations are of advantage to the one as well as the other, as breeders are directly benefited by an active interest prevailing for something they can produce. The trotter will thrive well in any good horse district, and the price city people will pay for a good one is far ahead of ruling rates for hacks and mongrel thoroughbreds bought for racing. Recently, in Melbourne, Speedway horses were sold at seventy and eighty guineas, while offers of 200 guineas and over have been refused for animals that had records of the mile in two minutes 20 seconds and a few seconds less. The trotter is well worthy of the attention of breeders, and Speedway Clubs that encourage them are deserving of the sympathy of all lovers of the breed.

Hacks and Hunters.

It is hacks and hunters the buyers abroad want for remount purposes. They have been sent away from here in thousands during the past good many years, but the supplies of real good sorts have been very short of late. The local demand for both kinds of animal is constant and fairly strong, albeit the bicycle and the motor have proved something of a rival. The best hacks and hunters are those from thoroughbred stock on one side, the male for choice. Good cross-bred mares, possessing substance and good appearance, mated with genuine thoroughbred sires, yield profitable results, provided always the main principles of breeding already set forth be adhered to.

Clevelands.

Little need be said of this breed of horse. It is is not popular in Australia, and this because the samples imported and bred here have not been, as a rule, satisfactory. They run to size, the height generally being from 16 to 17 hands. They have sluggish action, as compared with finer bred-animals, and as buggy and carriage horses their trotting speed is poor in comparison with that of the American trotter, who has lately come more to the front than in earlier days. A complaint against Cleveland horses is that they produce poor results when crossed with other breeds, and that the bone is generally of inferior quality, rendering the stock liable to leg weakness and such diseases as ring bones, curbs, etc., which troubles are fatal with horses carrying as much weight of body as the breed under notice.

Ponies and Galloways.

The pony and galloway for city work is becoming more and more popular, while the true pony is becoming more scarce as time

goes on. Pony breeding operations all over Australia would pay, partly because of the sound demand that exists, and partly because these animals, if properly bred, are more hardy than any other class of horse. The fault here has been want of system and too few importations of genuine ponies from abroad for stud duties. More than half the so-called ponies bred now are not ponies at all, but little horses. They are practically runts or dwarfs resulting from some process of mongrelising and starvation, which have served to destroy stamina, serviceableness, and beauty. Good, soundly-bred ponies are not only comely, but docile and strong, fit to work longer hours than many big horses, and stick to a task with astonishing pluck. There is room for many pony breeders in Australia, and the industry will pay well, provided that some good new stock be brought from Shetland, Wales, or Timor, all of which kinds have had numerous excellent representatives here in the past.

Mules.

A branch of the horse family well worthy of note is that derived from a cross between the donkey and the horse. Mr. W. T. Kendall, M.R.C.V.S., Principal of the Melbourne Veterinary College, has given a good deal of thought to this matter, and he is assured that mule breeding will pay in Australia. The following is an extract from a paper read by him at a conference held under the auspices of the Victorian Agricultural Department:—"Half of the mares at present breeding are not fit to breed to any horse, but many of them would breed good mules, and they could not be put to a better purpose, for the following reasons:—First, they are easily reared, are more serviceable for home use, and have a higher value for exportation. (Our low-grade horses are of no value for the latter purpose.) Second, mares unsuitable for horse breeding could be utilised, and the interests of breeders of good horses would not be damaged. Third, mules do not inherit unsoundness and other defects to the same extent as the progeny of horses.

"The Government would do a great deal more good by importing a number of selected Kentucky or Spanish jacks to let out at small service fees than by offering premiums to owners of stallions.

"Breeding from unsound culls, as at present, brings about deterioration by compound proportion. Every generation gets worse. Breeding mules from such mares would stop the deterioration at once, and only the best mares should be used for breeding horses.

"The market for mules is practically unlimited. For packing at the mines and most kinds of farm work they are superior to horses. The Americans, who are wide awake, prefer them for ploughing and working their big harvesters, etc. They are sounder, hardier, and more easily kept than horses, and where a long pull and a strong pull is required, as when hauling the big guns about over rough ground during the South African war, they have always proved their superiority.

"My son tells a story of a mule belonging to his regiment when at Belmont, which, after having one Mauser bullet through its chest and another through its flank, continued to eat and went on with its work just as usual."

ANALYSES OF SOILS.

The Department of Agriculture is now prepared to make analyses of soils, and furnish a full report on same, to all *bonâ fide* farmers and gardeners, for the sum of £1 10s. for each analysis. All samples to be delivered free at the offices of the Government Analyst, Wellington Street, Perth, accompanied by the above-named fee. The following instructions should be adhered to in taking samples:—

When the soil in a field is uniform, or nearly so, a spot is chosen from which to take the sample, or if an average sample is desired several spots are chosen. First scrape the surface lightly with a sharp tool to remove surface vegetation and half-decayed vegetable matter that has not as yet become part of the soil. Dig a hole 12 to 18 inches square and 12 inches deep. The sides of this hole must be perpendicular, and the bottom nearly horizontal. From one side cut vertical slices until about 10lb. of soil has been obtained, and place on a sack. The same thing is done at the other spots chosen. All the lots of soil are to be then thoroughly mixed together, and about 10lb. taken from the heap for a sample. This should be packed in canvas or a wooden box. A metal box must not be used. If a sample of the subsoil is to be sent for analysis it can be taken from the same hole or holes as the surface soil, and in the same manner, going 12in. deeper. Persons sending soils for analyses should state briefly, in the case of virgin land, the character and variety of timber growing on the land; the purpose to which the land is to be put; the configuration of the surface; natural drainage; average rainfall; whether it is proposed to irrigate; and any other particulars which may assist the analyst in prescribing manures. When samples are sent from old land it should be stated, in addition to the above particulars, whether the land has received any dressings of manures, when, and of what kind, and the crops that have been principally grown on the land since it was first cleared.

STATE FARM, HAMEL.

REPORT ON GRASS AND FODDER PLANTS.

TRIAL PLOTS, SEASON 1903-4.

By G. F. Berthoud.

Soil.—Low-lying loamy land, well ploughed and broken up, but not drained. Owing to the excess of rain which fell during the months of August and September all the varieties were damaged and checked by surface water, which also nullified the good effects of the fertiliser applied. The plots sown later in spring, after the heavy rains had ceased, gave more satisfactory results.

Culture.—All the varieties, from 1 to 60 inclusive, were sown in drills 15 inches apart, and kept free from weeds during the season.

Manure.—Composed as follows:—Four parts fine-ground bonedust and one part of sulphate of potash, well mixed before use, applied in the drills at the rate of 2cwt. per acre. Bonedust used by itself, or mixed with Thomas' phosphate or superphosphates, are good manures to use. The quantity applied should be not less than 2cwt. per acre, and if sown broadcast to be well harrowed in, and the soil worked to a fine tilth before sowing the seed. The following six hardy sorts have done well here, are relished by all stock, and in every way suitable for permanent pasture; can be safely recommended for general culture, in mixture or otherwise.

The best results will be obtained by sowing early in the autumn, hereby giving the young plants a fair start before the winter rains set in. During the first season farmers should not allow stock to graze on the newly-sown paddock until late in the summer. The plants will form good roots and some seed before they are eaten down. All up-to-date farmers should sow a few acres each year. The land should be clean, and fallowed in summer to obtain the best results. Reliable mixture for one acre:—

5 lbs. Cockfoot.
5 ,, Tall Fescue.
5 ,, Tall Oat Meadow Grass.
5 ,, Hungarian Forage Grass.
5 ,, Prairie Grass.
5 ,, Sheep's Burnet.

Several other varieties are equally useful, but the seeds are not easily obtainable. The white-flowered Bokhara clover is somewhat similar in appearance to lucerne, but of stronger growth, and more hardy. Horses and other stock eat it readily. Will give good results on ridges and well-drained soil. Sow 8 or 10lbs. per acre broadcast.

Summer Grass.

The Natal Red Top and the Paspalum are good, but being natives of tropical climates they require heat and moisture to bring them to full perfection. The seeds are very light, and adhere together, making them difficult to sow evenly. The best way is to rub out and mix with superphosphate or sand when sowing broadcast. Will give best results when sown in spring; does not germinate during the cold months of the year. Quantity per acre six to eight lbs.

No. 1: *Lotus Villosus*, Asia.—Sown 25th June; up 8th July; germination even and good; deep-rooting perennial herb; clover-like foliage; plant low, and spreading close to soil; height about three inches, by a spread of nine inches; stands heat fairly well; useful herb for sheep pasture; not very productive.

No. 2: *Birdsfoot Trefoil* (*Lotus corniculatus*), Asia.—Sown 25th June; up 8th July; germination even and good; perennial herb; clover-like foliage of slender, spreading growth, close to soil; height about four inches; keeps green all the summer; stands heat well; useful for sheep pasture, but not very prolific on this soil.

No. 3: *Lotus uliginosus*, Asia.—Sown 25th June; up 8th July; germination good; perennial herb; growth very low, creeping on the soil; foliage small and clover-like; stands heat fairly well; keeps green all the summer; very slow-growing variety; suitable for sheep only. Poor.

No. 4: *Hungarian Clover* (*Trifolium pannonicum*), Southern Europe.—Sown 25th June; up 9th July; germination rather poor and uneven; perennial variety; foliage large; plants dwarf; very slow in growth; stands heat well; keeps green all the summer. Would, I think, give better results on limestone country. Not very promising on this soil.

No. 5: *Trifolium filiforme*.—Sown 25th June; up 7th July; germination strong and even; annual variety; growth rapid and healthy; stalks and foliage small; flower-heads numerous, colour yellow, and seeds abundantly; height, one foot; plant covers a space of 18 inches with a close mat of succulent feed; good variety for winter and early summer; keeps green until Christmas; seeds shed freely, and start growing with the first rains in Autumn. Good for this locality.

No. 6: *Melilotus gracilis*, Asia.—Sown 25th June; up 7th July; germination even and good; annual of quick growth; stems slender; height, 18 inches; branches freely; productive of green feed during winter and spring; plants die off in November; foliage and flowers strongly scented; colour, yellow; may be useful for bees; sheds seeds freely, which come up early in Autumn.

No. 7: *Melilotus officinalis*, Asia.—Sown 25th June; up 8th July; few plants only; germination poor and uneven; deep-rooting variety, lasting several years; growth very slow; keeps green all the summer; height, nine inches; soil appears to be

unsuitable for the successful culture of this variety ; flowers sweet-scented ; said to be useful for bees. Not very promising.

No. 8: *Bokhara Clover* (*Melilotus Alba altissima*), Asia.—Sown 25th June; up 8th July; germination good; plant of very vigorous growth, lasting several years; in growth and foliage very like lucerne, but stronger and more woody; flowers white, sweet-scented; useful for bees; roots down deeply, and gives best results on high, well-drained land; height, two feet; branches freely; horses and cattle are fond of it; the best sort in this family; good useful plant.

No. 9: *Melilotus parviflora*, Asia.—Sown 25th June; up 7th July; germination good; annual plant of rapid growth; useful only for green feed in winter and spring; dies off in November; height, two feet; branches freely; foliage and flowers small, the latter yellow and strongly scented; seeds are freely produced and shed; hardy, but not a desirable plant to cultivate.

No. 10: *Melilotus sulcata*, Asia.—Sown 25th June; up 7th July; germination good; annual plant of rather dwarf and weakly growth; height, 18 inches; branches fairly; stems reddish brown; flowers small, yellow in colour; seeds freely, and dies off early in November; good only in winter and spring. Not desirable.

No. 11: *Melilotus cœrulea*, North Africa.—Sown 25th June; up 7th July; germination even and strong; annual plant; growth vigorous and tall, up to two feet; foliage clover-like, wide and soft, and light green; flowers pale blue, sweet scented; useful for green feed during summer, until about Christmas, when the plant dies off; seeds freely. Fair variety; worthy of further trial.

No. 12: *Melilotus segetalis*, Asia.—Sown 25th June; up 9th July; germination slow and very uneven, seed partly failed to come up; annual variety; growth slender; branches freely; height, one foot; flowers small, yellow, sweet-scented; seeds fairly well; dies off in November. Poor, and not a desirable plant for culture here.

No. 13: *Lucerne Hunter River* (*Medicago sativa*).—Sown 27th June; up 6th July; germination strong and good; growth even; plant stools out well; foliage pale green; flowers freely; height, 18 inches. During the very wet weather some patches turned yellow and sickly. However, taken as a whole the plot gave fair results. If the seed had been sown six weeks earlier the plants would have suffered less from the excess of moisture.

No. 14: *Lucerne Turkestan* (*Medicago sativa*).—Imported seed. Sown 27th June; up 6th July; germination even and good; very similar and in no way superior to the Hunter River or common variety of lucerne, except that the plants are more dwarf and compact. Results fair.

No. 15: *Cocksfoot* (*Dactylis glomerata*), Europe and North Africa.—Sown 29th June; up 17th July; germination even and fine; growth healthy and vigorous; plant stools freely, forming

neat dense tussock of good feed; some few plants flowered and produced seeds; height, to one foot. A superior hardy grass, suitable for general culture in the South-West districts; stands heat well; prefers soils which contain lime.

No. 16: *Timothy Grass* (*Phleum pratense*), Europe.—Sown 29th June; up 16th July; germination even; growth good; stools freely, forming low thick plants; foliage fine, tender, and of excellent feeding quality, some plants showing flowers and seed-heads. A good grass, but not equal to the Cocksfoot for withstanding the heat of our long summers. Fair.

No. 17: *Perennial Rye Grass* (*Lolium perenne*), Europe.—Sown 29th June; up 16th July; germination good; growth fairly strong and healthy; stools freely; makes good feed during the early summer; plants seeded; height, to 18 inches. Does not stand the long dry summer; nearly all the plants died after Christmas.

No. 18: *Tall Fescue Grass* (*Festuca elatior*), Europe.—Sown 30th June; up 16th July; germination even; growth very healthy and fine; plants stool freely; makes nice thick tussocks; foliage tender, and relished by all stock; height, to nine inches; did not produce any flowers, yet stands wet and heat well, keeping fairly green all the summer. I consider this hardy perennial grass to be one of the very best tested here, and worthy of extensive culture in the South-West district. Good.

No. 19: *Evergreen Meadow Grass* (*Poa sempervizens*).—Sown 30th June; up 19th July; germination slow and rather uneven; growth even and healthy; foliage tender, of fair quality; plants flower and seed freely; height, to 18 inches; stands heat moderately well; some plants dry off. Fair.

No. 20: *Festuca tenuifolia*, America.—Sown 1st July; up 3rd August; germination slow, but fairly even; growth good; forms little low tussocks of very fine, dark-green foliage; not very prolific; stands heat well; plants about four inches high. Did not produce any flower stalks, yet should be useful in mixed pastures for sheep. Fair perennial grass.

No. 21: *Poa compressa*, America.—Sown 1st July; up 1st August; germination slow, but even; growth healthy; foliage bluish green; low set, close to soil; spreads by stolons under the ground; towards the end of summer the leaves dry off, but the roots send up fresh shoots after the first rains in autumn; not very prolific; shoul l be useful in pastures for sheep; perennial. Fair.

No. 22: *Hungarian Forage Grass* (*Bromus inermis*), Europe.—Sown 1st July; up 18th July; germination good; growth slow, but even; forms low tussocks; foliage soft, of good feeding quality; plants have not produced any flower-stalks yet; height, nine inches; keeps green all through the summer; stands heat well. Promising perennial grass; suitable for culture in the South-West. Good.

No. 23: *Prairie Grass* (*Bromus uniloides*), America.—Sown 1st July; up 19th July; germination strong; growth upright and healthy, quick and strong; useful grass; relished by all stock, giving abundant feed during winter and early summer; plants seed freely; height, to three feet. Seed should be sown very early in autumn, say 1st March. Good grass for the South-Western districts.

No. 24: *China or Milk Clover* (*Astragulus sinicus*), China.—Sown 1st July; up 13th July; germination good; small clover-like plant, producing pretty pink flowers; growth poor and weak; height of plants about six inches, each one covering a space of some eight inches; dies off after Christmas. May be a useful plant on limestone soil, if sown very early in autumn. Poor.

No. 25: *Eragrostis silosa*, Australia.—Seed introduced by Mr. W. Paterson. Sown 1st July; up 21st July; germination even; growth very good, level, and vigorous; foliage rather harsh, long and slender; colour dark green, and purple brown at the base; forms large dense tussocks; plant throws up seed-stalk freely to four feet high; seed very fine; should be sown on surface without covering; stands wet and heat remarkably well, keeping green all the summer. Stock eat it freely in the fall, when more tender grasses are scarce. Useful hardy perennial; worthy of extensive trial.

No. 26: *Piptatherum multiflorum*.—Seed introduced by Mr. Wm. Paterson. Sown 1st July; up 21st July; germination uneven; growth slow, owing to plot being very wet; plant of slender habit; foliage deep green, tinted red; stands heat well; seeds freely; stalks to 18 inches high; feed good, but the yield is light; perennial; should be useful in mixtures for permanent pasture. Seed fine; sow without covering. Fair.

No. 27: *Trigonella corniculata*, Europe.—Sown 1st July; up 9th July; germination good; growth very poor, owing to late sowing and wet land; this is a useful annual herb, with dense trefoil-like foliage; should be sown very early in March, on well-drained high land; the growth will then be rapid, making good early winter feed for cattle or sheep; plant seeds freely.

No. 28: *Sainfoin or Esparsette* (*Onobrychis sativa*), Europe.—Sown 3rd July; up 14th July; germination even; growth very slow; many plants died off owing to wet; some few plants remained green through the summer; height, six inches; flowers pink. Soil not suitable for the culture of this plant; does well on limestone country. Poor.

No. 29: *Native Grass* (*Eragrostis sp.*), from Quindalup, Western Australia.—Sown 3rd July; up 1st August; germination slow, but fairly even; growth at first very slow, but when well established it forms fine strong plants; foliage rather hard, but fairly good; plant seeds freely; stands the heat very well; hardy perennial.

No. 30: *Egyptian or Bersin Clover (Trifolium Alexandrinum).*—Sown 3rd July; up 11th August; germination strong and good; white-flowered annual variety of strong growth, which does well on wet land; should be sown very early in autumn; will produce very fair yield of good feed during winter and early spring; it dies off in November; height, to two feet; seeds freely. Fair.

No. 31: *Crimson Clover (Trifolium incarnatum),* Europe.—Sown 3rd July; up 10th August; germination good; growth quick, even, and vigorous; height, to 16 inches; flowers and seeds well; will not stand heat; dies off early in summer; sheds seed freely; if sown early in autumn on suitable (limestone) soil will produce a heavy yield of good fodder. Good annual variety.

No. 32: *Yellow Hop Clover (Medicago lupulina).*—Sown 3rd July; up 12th July; germination good; growth very slender, slow, and weak; plant low and spreading; height, about six inches; flowers small, yellow; does not stand the heat; nearly all the plants died. Poor; not suitable for this soil.

No. 33: *Sheep's Burnet (Sanguisorba minor),* Europe.—Sown 3rd July; up 18th; germination even; growth healthy; forms low dense bunches of dark-green foliage, six inches height; flower-stalks are one foot high; stands wet and heat well; the roots penetrate deeply in the subsoil; perennial herb; good fodder for sheep and other stock. The best results are obtained on soil which contains lime. Valuable for culture in the South-West districts.

No. 34: *Sulla Clover (Hedysarum coronarium),* Europe.—Sown 3rd July; up 19th; germination good. Owing to the wet, and the soil being unsuitable, nearly all the young plants died off. The few left are very sickly and poor. Will do well only in limestone country. Failure here.

No. 35: "*Paspalum scorbularia,*" South America.—Sown 4th July; up in September; germination fairly good; growth healthy. This variety appears to be identical with the common kind, *P. dilatatum.* Plants stool out well, and seed freely. The seed should be sown very early in autumn, say in March, to catch the first rains, or else in spring, when the weather gets warm, in September. Valuable summer fodder for moist lands.

No. 36: *Japanese Grass (Brachypodium Japonica),* Japan.—Sown 4th July; up 25th; germination good; growth even and healthy; plant stools out well; foliage soft dark green, shaded purple; heads drooping; pale brown in colour; seeds freely; height, 18 inches; stands heat well. This is a fairly good grass, which lasts for several years. Worthy of further trial.

No. 37: *Bromus breviaristalus,* America.—Sown 4th July; up 23rd; germination fair. During the first season this perennial grass is a slow grower, but it stands the summer heat well, and yields good feed the second season from time of growing. Valuable

for mixture in permanent pasture in the South-Western districts. (Seed first introduced by Mr. Percy Wicken.)

No. 38: *Italian Rye Grass* (*Lolium Italicum*), Europe.—Sown 4th July; up 18th; germination good; growth very rapid and level; if sown early with the first rains, will produce a heavy yield of splendid green feed for winter and spring. The plant stools freely and seeds well; the stalks are up to 2ft. 6in. high; dies off after middle of November. Valuable annual grass for the South-West.

No. 39: *Tall Meadow Oat Grass* (*Avena elatior*), Europe and Asia.—Sown 4th July; up 19th; germination fair; growth healthy: stands heat well; keeps green nearly all summer; stools well; foliage soft; of fair quality; seed stalks up to four feet high; if sown early would be very useful mixed with other grasses. The roots penetrate deep in the subsoil. Said to give good results on sandy soils.

No. 40: *Panicum flavidum*, Australia and Asia.—Sown 16th October; germination good, but a large number of the plants were destroyed by cut worm. This Australian grass makes very good growth here, and stands the heat well; the plant stools out well; grows low down, close to the soil; each plant covering a space of about three feet, with nice green feed; seeds well. Very promising grass ;worthy of further trial in South-West and elsewhere.

No. 41: *Mitchell Grass* (*Astrebla elymoides*).—Sown 16th October; germination bad; only a few plants came up; the young plants are at first very weakly, easily blown over and destroyed by the high east winds which often prevail here at night in summer; stands the heat well; plants about two feet high; blade soft and bluish-green; seeds fairly well; stock are very fond of this grass; promising for further trial.

No. 42: *Diplachne fusca*, America.—Sown 16th October; germination even and good; growth strong and healthy; foliage and stalks fine; stools out well from the base; seed heads numerous and mature well; stands heat fairly well; appears to be a good fodder plant; height two feet six inches, level and even; promising.

No. 43: *American Grass* (*Diplachne sp.*), America.—Sown 16th October; germination bad and only few plants came; plant forms a large bunch of soft deep green foliage, and should be of excellent quality for stock; seeds freely; stalks up to three feet high. Very promising grass for summer use.

No. 44: *Eragrostis Maxima*, Mexico.—Sown 16th October; germination fair; plant of prostrate habit of growth, stooling out from the base and covering a space of about four feet on good soil; seed heads freely, produced on stalks one foot high; foliage soft; fair grass for culture on low, moist summer lands; fair.

No. 45: *Panicum decompositum*, Australia.—Sown 16th October; germination good; young plants partly destroyed by cut

worms; vigorous perennial grass; foliage and stems soft; valuable summer fodder; does best on rather low, moist lands of good quality; stools well; seeds freely produced; ripens unevenly; height two feet, covering a space of about three feet; a valuable nutritious grass.

No. 46: *Panicum prolutum,* Australia.—Sown 16th October; germination very even and good; growth very free and vigorous; foliage and stems fine and tender; splendid grass for summer use; stands the heat well; height two feet six inches; sheds ripe seeds easily; ripens very unevenly; will give good results on soil that retains some moisture during the summer; good.

No. 47: *Milium multiflorum.*—Sown 16th October; gemination uneven; seed partly failed to grow; plant of slow and weakly growth; stem very slender, will not stand much feeding off; the foliage is wide, tender, bright green colour, and of good quality; stands heat fairly well; the plants may prove to be more prolific this season; they are now (May) making fine new growth.

No. 48: *Eleusine Coracana,* Persia.—Sown 16th October; germination good; strong annual fodder plant; growth vigorous during summer months; if sown on fairly moist soil, stems and foliage are not hard, makes fair feed; seed heads of curious shape, heavy, well filled with round brown seeds; height 2ft. 6in. In India it is esteemed for horse feed.

No. 49: *Eleusine Indica,* India.—Sown 16th October; germination even; an annual plant from India, in habit more slender and prostrate than the last; foliage narrow, rather tough and hard; forms large low plants, covering a space of about three feet; seeds are freely produced; the heads are curious and ornamental; not very valuable for fodder.

No. 50: *Natal Red Top Grass (Panicum roseum).*—Sown 16th October; germination even; growth vigorous, without being coarse; plant stools out well, forming large tussocks; foliage and stems fine and tender; all stock eat it readily; height three feet, with a spread of four feet; the seeds are light and fluffy, thereby sowing itself over pastures; it is a summer grass; gives good results on soil which retains moisture during the hot season.

No. 51: *Satin Top Grass (Andropogon erianthoides),* Queensland.—This hardy perennial grass gives good results here; grown on rather high ground; forms large close tussocks of bluish green foliage; said to be very fattening for cattle in its native State; the growth is at first slow, but it makes a nice strong plant the second year; keeps green all the summer and autumn; seeds well; stalks up to five feet high; worthy of trial by farmers.

No. 52: *Kimberley Grass (Andropogon formosus),* Northern Australia.—Very strong growing perennial grass; foliage long and wide; feels rather harsh to the touch, but stock eat it freely when more tender grasses are dry; on moist lands it forms large plants five or six feet across; keeps green all the year; the seed panicles

are 18 inches long and resemble oats; they appear in winter here, and do not mature properly; stock are fond of them.

No. 53: *Cane Grass*, Western Australia.—Hardy perennial; native of Coolgardie, where it grows along the margin of the salt lakes; here the old plants are up to nine feet high; the stems are rather coarse, but the young plants are fairly tender and good for stock; seeds fairly well; sown here 16th October; some of the plants were six feet high by the end of April.

No. 54: *Coapim Grass* (*Panicum Spectabile*), West Africa.—This luxuriant perennial grass yields a wonderful quantity of tender green foliage throughout the summer, relished by all stock. Here the main plant is about three feet high in the centre, and throws out a thick mat of runners in all directions; these are from 10 to 15 feet long, forming roots at every joint. In warm climates, when grown in moist swampy places, it covers the ground very quickly. Here it does not produce any seed, but may be easily propagated by rooted joints; valuable on moist land.

No. 55: *Giant Millet* (*Pannicum Gigantum*), Japan.—Sown 27th October; germination quick and even; annual forage plant of strong rapid growth; foliage wide and soft, should be good summer feed for cattle; may be cut several times; when allowed to grow attains the height here of from three to four feet, producing seeds freely. Heads large and well filled, with small round light brown seeds, which are said to be very fattening for poultry.

No. 56: *Reana luxurians* (*Teosinte*).—Sown 31st October; germination quick and even; annual plant from Guatemala, Central America. This is one of the most luxuriant and productive of known forage plants; but being a very strong feeder it can be successfully grown only on rich, warm, moist land. Here grown on the low ground along the brook, planted in hills four and a-half feet apart, three seeds to each; the plants have done well, attaining the height of 10 feet, yielding 70lbs. weight of green fodder per hill, or at the rate of over 60 tons per acre. Plant stools freely, and each stem makes numerous side shoots; foliage long and wide; all parts rich in sugar; relished by all stock. Doubtful if seeds will mature here.

No. 57: *Paspalum virgatum*, Mexico.—Strong, tall, upright, perennial variety. Here it grows freely in any soil, attaining the height of three to seven feet; seeds freely and liable to spread over cultivation paddock; foliage rather rank and coarse. Stock will not readily eat it until other and more tender grasses are done. It is, however, useful as a stand-by for stock in the autumn and early winter months, when the better grasses are still scarce.

No. 58: *Spekboom* (*Portulacaria Afra*), South Africa.—This is a low shrub with shining green, round, succulent leaves and tender shoots; said to be of excellent quality for sheep pastures. Imported cuttings planted 22nd July; the plants struck easily, and have since made slow but healthy growth; they are now (April)

about nine inches high and branching freely; appear to stand heat fairly well; promising.

No. 59: *Pentzia virgata* (*Sheep's Bush*), South Africa.—Dwarf shrub, here attaining the height of 18 inches, with a spread of two feet. The leaves and twigs are slender and strongly scented; the low branches often form roots; flowers yellow; growth slow; stands the heat well; may be useful for planting on poor, stony land; said to be excellent feed for sheep.

No. 60.—*Strawberry Clover* (*Trifolium fragiferum*), North Africa.—Dwarf creeping perennial species; useful for low, wet land. The branches root at every joint, forming a dense mat of dark green foliage. Cattle are very fond of it; said to be very fattening; it stands the heat well. So far the plants have not seeded, but it may be easily propagated by rooted cuttings. Good.

POULTRY NOTES.

By Frank H. Robertson.

The question of moment just now is what and where to buy the poultry required for the coming season, both by the old and experienced breeder and the novice. The former is critical, and hard to please; but, as he knows exactly what he wants and where likely to get it, he narrows his visits of inspection to one or two yards which he knows have, or should have, good stock of the varieties he requires.

The novice, on the other hand, roams around all the yards he can reach, writes to breeders all over the country in search of good birds at as low a price as possible, and eventually succumbs to the purchasing of birds from the man who is the best salesman, and who has been able to impress the purchaser with the wonderful quality of his stock by such statements as that such and such hen is mother, aunt, or half-sister to the one that took first special and champion at the last big show, or that the cockerel is from the same strain that won all the first prizes at Melbourne or Sydney, and such like, but omits to mention that his yard is badly tick-infested, or that the birds sold have been pampered and reared like hot-house plants, not knowing what it is to have an open run, and have only barely sufficient room to flap their wings.

As most people want good, sound, well-grown fowls which will lay well and breed satisfactorily, it is quite a matter of indifference whether they or their relatives have had a victorious career in the show pen or have never faced the admiring crowd. If the actual birds bought are not individually of fair quality they are none the better for having a pedigree. The great point for the beginner to bear in mind when purchasing is to learn something of the character of the breeder he is buying from, and ascertain, if possible, if he bears a good name for fair dealing. Having satisfied oneself on that point, go to his yard and see for yourself how the stock are kept. Notice the size of the runs, do the fowls look bright and healthy, and has the whole place a general appearance of care and attention, and is there any tick in the place. Having found such a breeder, it will generally be found that his prices seem higher than was expected, especially when the best fowls are priced. As a rule, it will be found better to pay a full price and have the satisfaction of knowing that the stock is sound and what it is represented to be, rather than by purchasing attractive-looking birds at lower prices from unreliable vendors. As to prices of pure-bred poultry, they of course vary very much, just the same as any other live stock. For instance, a cow could be bought for, say, £3, and another one would cost, say, £20. Every buyer of stock understands that it is a question of quality; but taken as a general rule, to buy fair specimens of pure-bred fowls from reliable breeders would cost from 15s. to 20s. per bird. Culls and inferior can be bought at lower prices, ranging from 7s. 6d. to 10s; but for show specimens the prices range considerably higher, generally from £2 to £10 for an extra fine one.

Having selected the fowls, to be on the safe side it is a good plan to quarantine them in a small pen, in a distant part of the yard, for about 10 days, to make sure that they are free of all complaints, and especially tick. To ascertain this point, make a critical and close examination of the perches and woodwork near which the fowls are roosting, especially in cracks and crevices, or underneath where one piece of wood covers another. Any tick that may have been on the bought fowls would have dropped off before tht end of the 10 days, and if none are to be found in the perches then the qnarantine can be safely dispensed with, and the birds put into their permanent breeding run, but if ticks have dropped off during the quarantine, the safest plan is to burn the box or shed the fowls had been kept in.

In selecting stock to breed from, if birds under 12 months are bought, that is cockerels and pullets, do not get them immature and late hatched, but for preference take second year hens and mate them to a vigorous well-grown cockerel or a two-year-old cock, if pullets are bred from a cock is to be preferred to a cockerel; but whatever you do don't leave the mating of the breeding pen until late in the season, because early hatched chickens are the best. It is not too early now to make a start; June hatched chicks mature quickly and make fine big strong birds.

The next question is, what is the best breed to go in for, it being understood that it has already been decided to keep pure-breds, and only one kind at that, which is decidedly the best lines for the ordinary amateur to go on; and to simplify matters it is wise to commence with a breed that will go broody, as it saves the trouble of hunting about for broody hens when the breeding season comes round, also enables one to do without an incubator; not that these machines are to be avoided, far from it; because, to raise poultry to the best advantage on a large scale artificial incubation must be resorted to, but for the beginner, let him first learn how to handle fowls and rear chickens by the ordinary old-fashioned methods, and when this can be successfully managed then an incubator can be purchased if it is found that one is required to get out the number of chickens required. The best all-round breeds, such as Orpingtons and Wyandottes, are fine fowls both for the beginner and the old-established farmer. Then there are Plymouth Rocks and Langshans, but some descrimination is necessary in selecting the last named, as in many instances they have been bred too tall for utility purposes, and in purchasing commence with fair well-grown and fully-developed specimens of whatever breed is decided on. The person who has £5 to invest for this purpose will be acting wisely if he gets five birds at £1 each, instead of 10 birds at 10s. each. This is one of the hardest things to understand by buyers, because common hens can be bought at 3s. or 4s. each, yet 10s. to 20s. is asked for pure ones, but it is soon found out by reason of the law of supply and demand, and there are always plenty of buyers on the look out for good fowls at good prices at the same time.

The person who knows nothing about fowls and has never kept any should start with some common ones, and learn how to handle them, for at least one season, before venturing on the pure breds; and even then, unless an interest is taken in the fowls, they should be left alone, for unless an eye is kept to their requirements success cannot be looked for. Interest is the key-note to success, and a good way of working this point is to offer a pecuniary inducement to one of the junior members of the household, a bonus of, say, 6d. per head on all chickens raised up to six months old would offer a good inducement, and if, say, a commission of $2\frac{1}{2}$ per cent. is paid on all sales it would be found to work well. The lad in charge would look on every chicken lost as money out of his pocket, and would of course take all care to keep the losses as few as possible.

HANDLING AND STORING OF WHEAT.

QUESTION OF "YOUNG MEAT."

PROVISION FOR AN EXPORT TRADE.

The following correspondence has passed between the W.A. Producers' Co-operative Union, Ltd., and the Premier on the above subjects:—

Commercial Union Chambers, St. George's Terrace,
Perth, 22nd April, 1904.

To the Hon. the Premier—

DEAR SIR,—The revolution which has been effected in cereal culture in this State through the use of commercial fertilisers has made it apparent that at an early date the production of wheat will require provision, and ample provision, for its handling and storing for shipment. The directors of the W.A. Producers' Co-operative Union desire to bring this matter prominently under the notice of the Government, with a view of urging that immediate provision be made for ample space being apportioned to this coming important trade at the Fremantle wharves.

The main object to be attained is accommodation for storing direct from the railway service large bodies of grain in such proximity to the shipping berths as may secure the loading of ships with the maximum of speed and the minimum of cost. Behind this it is important that facilities should be given to farmers to store their grain on the railways, where it may be held by an association, insured, and advances made upon it, thus enabling the farmer to carry his grain from the farm during the dry season of the year and supply himself with funds without being compelled to sell or store in a mill.

This system would also be favourable to the railway, by distributing the grain traffic over a considerable period of the year.

Another silent, almost unnoticed, revolution has been proceeding during the last decade, which is rapidly altering the condition of the live stock productions. The public has lately discovered that lamb and two-tooth sheep are more palatable than mutton from three and four-year-old sheep, that six-month-old pig makes better pork than the two-year old, and that "baby" beef is preferable to that from the four and five-year-old bullocks of the past. The inevitable result of this altered taste is that the public will call more and more upon the farmer to supply its wants in this direction. It is important to realise that the production of this class of meat belongs, not to the squatter in the North, but to the farmer with whom wheat-growing and "young meat" production are twin industries, and in a large measure independent.

This being so, a surplus of wheat will point to a subsequent surplus of exportable meat, for which due provision will be needed in the form of cold stores at the port.

Again, fruit export is within a measurable distance of time, needing recognition.

It is the extreme importance of foresight in making provision for this coming export trade which has moved the directors of the Co-operative Society to bring the matter prominently under the notice of the Government.

It is felt that an early recognition in a practical way of this trade (as above suggested) will do much to maintain healthy hope and vigor in land settlement,—Yours faithfully, Charles Harper, chairman of Directors, W.A. Producers' Co-operative Union.

THE PREMIER'S REPLY.

Sir,—I have the honour to acknowledge the receipt of your letter of 22nd April, having reference to making provision for handling and storing of wheat, etc.

I am glad to have my attention drawn from an outside source to the subjects dealt with in your letter, as Mr. Hopkins has been urging forward the need for giving consideration to such questions.

I will confer with the Lands Department and Harbour Trust, and write you again.—I have the honour, etc., Walter James, Premier.

SEASONABLE NOTES FOR FARMERS.

By Frank L. Faulkner.

This month having opened with a really fine general rain, farmers will do well to take the fullest possible advantage of it, and get as much crop in as possible while the land is still warm and forcing.

Those farmers having their land fallowed ready, and in a nice tilth, will be able to push their seeding right away, and apart from obtaining better yields through the advantages of bare fallow, will without doubt benefit by being able to get their crop in early and at a time when conditions are most favourable to a thorough and healthy germination. In preparing land for the cereals—wheat, barley, and oats, the typical seed bed is obtained by bare fallowing, or on land that has previously borne a summer crop kept cultivated and clean. On such properly treated land the tilth obtained is nice and mulchy to a depth of two to three inches, and below that a firm, well settled, but not hard bed. Land that is ploughed up

and intended for these crops directly after should not be ploughed more than four inches deep; then it should be deeply cultivated once in order to disarrange and break the furrow slices. After that harrow thoroughly to settle the lower soil and bring the top to a good tilth. Land deeply cultivated just previous to sowing, or in fact any soil that has a lumpy and hollow seed bed, seems to settle and fall away from the young roots of the crop before they get thoroughly established, resulting in what is often termed "root failure." A soil thus prepared, or, more correctly, unprepared, dries up and loses its moisture much more readily than one that is well cultivated. Clods are great evaporators of moisture, and when on the surface allow a lot of surface exposure.

Plenty of harrowing and surface cultivation at a time when the land is nicely moist and working well will always be more than repaid by the returns. Farmers should make the selection of their seed an important point, as, under exactly similar circumstances, one variety will almost double the returns of another. To state definitely which are the most profitable varieties of wheat, barley, or oats would be an impossibility, as different varieties thrive under different conditions. In selecting seed try to get that which suits your conditions as near as possible. To a great extent this is found out by experience, but there are rules to go by to a large extent. For instance, an early and quickly maturing wheat is necessary for a dry district where the season terminates quickly, and as one approaches the wetter and later climates, the later wheats, as a rule, give better results. Where a farmer is growing for grain, a variety that is known to head well should be sown; but if for hay, a variety that gives a bulk of good quality straw would be better. A farmer that has to rely on the stripper as a means of harvesting should select a good standing wheat, not too hard to thresh; whilst, on the other hand, these points are of little importance where the binder and thresher are used, and a wheat that shells easily is rather a disadvantage.

Select seed that is known to be from a strong, healthy crop, as the same laws of heredity apply to vegetables as to the animal kingdom. Seed from crops that have not been selected and well cared for rapidly degenerates. As a rule, freshly-selected seed from a good variety gives very marked results.

Select seed that is known to withstand the effects of diseases most liable to the crop. Farmers in Western Australia have so far had very little experience with terrible parasite "rust," but in order to guard against it they would do well to select those varieties known to withstand its effects.

In order to guard agains "Bunt" or "Fishy Smut" (*Tellitia Caries*) in the case of wheat, and "Powder Smut" (*Ustilago carbo*) in the case of oats and barley, all seed should be pickled before sowing. For Bunt the simplest and very effective method of pickling is with a solution of from one to two per cent of bluestone (copper sulphate), varying the strength of the solution according to the perceptible quality of the grain.

The seed should be thoroughly immersed, sack and all, in this solution for a minute. A quick method of making the solution is to throw 5 kerosene buckets of water to 2lb. of the crystals into a cask, using a small sack kept near the surface of the water in which to put the bluestone crystals. This makes a one per cent. solution, which is quite strong enough, unless the seed shows signs of bunt. After pickling, allow time enough before sowing to thoroughly dry the seed, and *do not* put the seed into an unpickled bag. For barley and oats the treatment differs, although the smut develops in the first stages very similarly to the bunt. The reason for a difference is that the smut germs find their way into the closely-fitting glume or covering of the grain and become grown over, thus escaping the effects of the pickling. The most effective method of dealing with these germs is to apply heat, in the form of hot water. The seed is immersed in water at a temperature of about 125° Fah., and then allowed to dry thoroughly. The effect of this treatment is that the heat kills the smut germs, but is not sufficient to destroy the seed.

In sowing the seed, if the land is in a good state for germination, sow deeply down to 2½ inches, but if the land is dry and pulpy and liable to malt the grain, drill as shallow as is possible. In the former case the deep drilling makes the crop more able to stand heavy rough weather. In the latter case, the seed will lie for several weeks, and not germinate or malt; even light rains will not start it, but in the event of a fair or heavy rain the soil washes from the top of the drill ridges, covering the seed more deeply and ensuring a germination.

In sowing, always try to force the seeding as much as possible just when the land is in condition, if necessary leaving any other work that can be done at a less opportune time. A week's difference in the date of sowing will often make a difference in the results of several bushels.

Farmers that have not already done so should try and get in a few acres of white mustard or rape. This will give them a supply of early feed for the cows. If sheep are kept, the stubble crops that have been cut for hay can be made to supply a large quantity of early feed by simply scarifying in about 6lb. or 7lb. of rape seed per acre and harrowing it down.

For a fodder to last well into the summer and stand a lot of feeding, kale sown this month or next and left to get a good start should give very good results in many parts of Western Australia. In order to get a supply of vegetables during the winter, farmers should plant a few of each of the vegetables suiting the conditions, putting in a small number or patch, as the case may be, at intervals of a fortnight or so, planting them when conditions are favourable, *i.e.*, just after a good rain or just before, if a proficient weather prophet.

Farmers having a piece of soil capable of being irrigated or flooded, or a soil with a permanent soakage at from 10 to 12 feet

or less, would do well to plough it up very deeply, work it down fine, and try lucerne on it, putting the seed on—8lb. to 12lb. per acre—as soon as the worst of the frosts are over. However, in the drier districts, lucerne that is put in earlier and gets established before the dry weather sets in will be found to do better.

During the cold weather that may be expected from this on, stock on the farm should have access to good, warm shelter. Dry and young stock will do remarkably well if allowed to pull at a straw stack. Working horses should have good feeding and shelter, but I do not think they are any the better for being closely stabled all night. If given the run of a good stubble paddock after they have finished their night's feed they seem less liable to colic, etc., and to do generally better—unless their stables are exceptionally good and their bedding and treatment very thorough.

SUBSIDIES TO SOCIETIES.

The Hon. the Minister has approved of the following regulations with respect to subsidies to Agricultural Societies on prize money paid at shows, etc., as follows:—

1. Subsidy on the basis of 10s. in the £ on actual cash prizes may be paid—

   (*a.*) To Agricultural Societies.
   (*b.*) To Horticultural Societies (subsidy not to exceed £10).
   (*c.*) To Poultry Societies, not exceeding £25.
   (*d.*) To Ploughing matches held by recognised Society, not exceeding £10.
   (*e.*) Pruning Contests held by recognised Society, not exceeding £10.

Conditions.

2. That all classes in the Show are open to the public on payment of a moderate entrance fee.

3. Subsidy will only be paid on actual cash prizes (not on the value of medals or trophies of any kind).

4. Subsidy will be paid on purely Agricultural items—wines, fruit preserves, butter and cheese made in this State—but not on any other manufactured goods or on educational or industrial items, or on log chopping, etc.

5. Subsidy to Poultry Societies will be paid on poultry only.

6. Subsidy will only be paid when application is made in forms provided by the Department.

7. Applications for subsidy must be made within one month of holding the Show, and no subsidy will be paid for Shows during the preceding 12 months after the 30th of June in each year.

8. Applications must be accompanied by prize schedules, and no application will be entertained unless schedule is sent.

9. In cases where pro rata prizes are paid, the number of entries must be stated, and the actual prize money paid in each class.

IN SEARCH OF PARASITES.

The following letter has been received from Mr. Cooper, the State Commissioner of Horticulture for the State of California, in reference to that State bearing part of the expenses of Mr. Compére, the entomologist of the Department of Agriculture of Western Australia, who is travelling in search of parasites:—

Sacramento, Cal., 2nd March, 1904.

To the Department of Agriculture, Western Australia.

A. Crawford, Acting Director.

Dear Sir,—I beg to acknowledge receipt of your communication of January 9th, No. 102/513. I had the pleasure of meeting George Compére in San Francisco on the 29th ulto. Yesterday he proceeded with me to this city. We had an interview with His Excellency, George C. Pardee, Governor of California, and agreed upon a plan of united interest in the search for parasites.

Within is a copy of my letter to the Governor, containing the agreement. If this agreement is satisfactory to you, please answer by return mail; or, if any amendments are required by you, please interpose them and send to me for our consideration.

There is no doubt in my mind but that Mr. Compére will secure the parasite of the fruit fly that has been such a pest in your State.

With regard to our funds to be expended for the investigation of parasites, after many interviews we finally succeeded with the Attorney General, who is one branch of the State Board of Examiners, to draw from another appropriation. I had written to George Compére about one month ago to this effect.

I have, etc.,

Ellwood Cooper.

To His Excellency,
Dr. George C. Pardee,
Governor of California.

Sacramento, Cal.,
1st March, 1804.

Dear Sir,—In accordance with our several interviews, I have consummated an agreement with George Compére, to be submitted to the Agricultural Department of the West Australian Government for their ratification, the same being a joint interest in the investigation and search for parasitic and predaceous insects to destroy and keep in check insects that prey upon fruits and fruit trees; the joint interest to begin on 1st January, 1904, and terminate 30th June, 1905.

George Compére is to proceed with all possible despatch to Brazil, South America. This special voyage being more particularly for searching for the parasite of the West Australian fruit fly, but in the same voyage to investigate other parasitic insects that may be important to either State. After a reasonable search and investigation, to proceed to Europe to

investigate and procure parasites for the Codlin moth, to be furnished to our quarantine office in San Francisco, and to West Australia if that State so desires.

Future voyages or emergencies are to be determined and directed by the California State Horticultural Commissioner.

George Compére is to make a detailed statement in duplicate, one for each party in interest, also a careful itemised account of every expense incurred, one copy for each party in interest.

The West Australian Government is to pay all expenses, not including salary, and to draw on the California State Horticultural Commissioner, at their option, or at such times as they may deem best after the payment of expenses actually made, for the one-half, it being a joint interest.

Salary.—The West Australian Goverment to pay, on salary account, to George Compére, per month, £20 16s., equal to 100·00dols.; California to pay, per month, 100·00dols.

Respectfully, yours,
ELLWOOD COOPER,
State Commissioner of Horticulture.

Cause of Death of Forest Trees along the Great Southern Railway Line.

By ALEX. MORRISON, Government Botanist.

Having further observed the condition of the forest trees near the Great Southern Railway, while on a recent journey along that line, I have the following remarks to make in reference to the cause of their death, supplementary to the report made on 7th July last:—

I observed that the great majority of the dead and dying trees had suffered injury from bush fires. A large number bore evidence of the trunk having been scorched or charred at a spot close to the ground, where probably the herbage or fallen branches, on igniting, had brought the fire to bear effectively on the bark. The injury thus caused had resulted in the partial death of the tree at and above that spot, so that we see many trees standing with a strip of dead wood exposed on the surface of the trunk and extending from the ground up to and involving the branches springing from the corresponding side. The rest of the trunk, and the branches in connection with it, may still have a sound and healthy appearance, but after a serious injury of that kind the tree cannot continue to grow and thrive, and must die sooner or later. So many of the trees, especially the wandoo or white gum, illustrate in this way the effect of fire, in all degrees of severity, that the conclusion is unavoidable that bush fires are the main cause of the death of so

many of the trees in this part of the State. There seems to be nothing to forbid this conclusion, although doubtless a certain number of trees die from other causes.

Along the Great Southern Railway there appeared to me to be a considerably larger quantity of dead timber on its western side than on the eastern, and if this estimate is correct, it wou d appear as if sparks from the railway engines had sometimes caused the bush fires, the dry easterly winds during the warm season carrying the sparks to the west side at times when the bush is most easily ignited.

These facts supply a forcible illustration of the harm done by bush fires. The wandoo, and jam furnish timber of great value, though the former does not seem to be highly esteemed where it grows, and both suffer severely from this cause. Another tree, the so-called "mallet," which seems to be the same species as the gimlet (*Eucalyptus salubris*), or a variety of it, is now being exploited for the sake of its bark, which contains a high percentage of tanning ingredients, and on account of either its timber or bark is worth preserving from the ravages of fire. The leaves of this species also are particularly rich in oil, so much so that Baron Mueller named it "salubris" on that account, and he remarks that "it is the extraordinary abundance of oil in the foliage which renders this eucalyptus significant, and the oil from this and allied species is doubtless destined to become an article of export from Western Australia."

28th April, 1904.

CIDER MAKING.

When we consider what a very refreshing summer drink can be obtained from the apple when made into cider, it is surprising that some of our orchardists do not grow a few of the varieties of apples that are particularly adapted for first-class cider making.

It is a drink that, if it could be obtained at a reasonable price and of fair quality, would very soon be a most popular beverage. Again, the time is not far distant when our supply of apples will exceed the local demand, and to no better purpose can the surplus crop be put to than of making a healthy and refreshing summer drink.

Last year the Board of Agriculture of England published a report on the work done towards furthering this industry, by Mr. F. J. Lloyd, and I cannot do better than give it here. To those

who would like to know more about the matter, I would suggest that they write to the Department, when their queries will be replied to.

"RESULTS OF INVESTIGATIONS BY F. J. LLOYD, F.C.S., F.I.C.

"INTRODUCTION.

"The object of science is to teach men how to control, so far as may be possible, the forces of Nature. It is evident that before we can control them we must thoroughly know and understand what these forces are and how they work. It is by studying these natural agents, and then by showing men how to control their effect in the industry with which they are concerned, that science becomes of practical value. Probably no industry depends so much upon natural forces as does that of agriculture; hence no industry should derive greater benefit from science. And this is especially true of that branch of agriculture—the Cider Industry.

"Cider is the fermented juice of the apple. There are two varieties. Sweet cider, so called because it has a sweet taste, for fermentation has proceeded only slightly, and much of the natural sugar of the juice is left in the liquid; and dry cider, in which fermentation has proceeded so far that but little of the original sugar remains.

"Cider made in one district will differ materially from cider made in another district, and that made on one farm will differ from that made on another farm in the same district. Indeed, when these investigations were first started it was even difficult to find two or three barrels in the same cider-house which were alike. Uniformity of product is essential to success in all industries, and therefore such a state of affairs was very unsatisfactory to those who were interested in cider-making. No man in England has done more to really promote the cider industry than Mr. R. Neville Grenville, of Butleigh Court, Glastonbury, and how the experiments on which I have now to report were started is best told in his own words, taken from an admirable article entitled: "Some Practical Hints on Cider-making,' which was published in the journal of the Royal Agricultural Society of England in 1901:—

"'In 1893, the Migratory Cheese School of the Bath and West of England Society was being held on one of my farms at Butleigh, and Mr. F. J. Lloyd, under whom it was carried on, kindly consented to keep his laboratory going after the Cheese School was over, and to turn his attention to the scientific examination of the cider problem. The following year, 1894, I induced the Bath and West of England Society to take the matter up in earnest, and from then until now they have carried on the scientific part of the experiments at Butleigh, I undertaking to provide the apples and the necessary plant for the work. The Board of Agriculture latterly helped the society to the extent of £100 a year.'

"The results of these experiments were published each year in the journal of the Bath and West of England Society. The same subject thus became mentioned in various years, and the information was disconnected and intermittent. At the request of the society, I have prepared for the Board of Agriculture the following consecutive account of the work done. It does not pretend to be more than a re-arrangement of my previous reports. Although I have not attempted to make it a treatise on cider-making, but have confined the report almost entirely to the work done at Butleigh, yet it covers most of the ground of cider-making.

"Some see, or pretend to see, in these experiments no other result than that they have impressed upon all cider makers the necessity of cleanliness. To say that cleanliness is essential to success in cider-making is merely to utter a platitude. It is a simple expedient on the part of those ignorant of detail to hide their ignorance under a general principle. Undoubtedly the secret of success in cider-making, as in dairying, is cleanliness; but while it is easy to say this, it is very difficult to realise what this cleanliness is and how it may be best attained. Numerous precautions are required, many of which at first sight seem almost unreasonable. Cleanliness is necessary in the orchard, in gathering, storing, and grinding the fruit, and in pressing the pomace. It is necessary in handling the juice, in storing it, and in purifying it from sediment. Needless to say, it is necessary in every article with which the cider comes in contact in the cider-making and storing rooms, and in the people who have to deal with the manufacture. To arrive at the perfection of cleanliness has been a constant effort of the experiments at Butleigh. But even after some years of work we have not yet discovered all the ways in which cleanliness can be observed. To realise the conditions which make for cleanliness has been one of the main objects of the experiments, and how this has been done will be fully stated in this report. But to explain what cleanliness is, and whence uncleanliness comes, how to remedy it, and how best to treat cider in which, from want of cleanliness, certain injurious changes have taken place, is the work of the scientist, and is as yet scarcely trodden ground.

"In the course of my experiments it soon became evident that the final product—cider—depended for its character on three great factors:—

"1st—The composition of the apples and the juice obtained from them.

"2nd—The methods of manipulation, and apparatus in making the cider; and

"3rd—The fermentation which takes place in the juice.

"All these have been studied; what seemed to be improvements have been introduced, and the changes which take place, and which

in the past were, one may say, absolutely uncontrolled, can now be, and, by the best makers are, carefully controlled. Where before good cider was a chance product, it is now the result of carefully controlled action. In fact, an attempt has been made to lift the manufacturer of cider out of the rut of rule-of-thumb, and to make it a scientific industry.

"People who will not take a little trouble to make good cider had better give up cider-making altogether. They destroy the reputation of cider; they cannot sell what they make, and those who drink the stuff they produce would be better in health without it. Such cider-makers will learn too late that they have allowed an opportunity to slip which will not return. How true this is may be best shown from the following facts:—Large quantities of apples were sold in Somerset in 1897, which were taken to France for the manufacture of cider. How was it that the French cider-maker could afford to buy apples in Somerset at a price which presumably paid the Somerset farmer better than converting them into cider? It was simply because many Somerset farmers have not learnt how to make a drink which can compare in quality with that made by our neighbours across the Channel. If this continues, what will be the result? The demand for cider, which is growing rapidly in England, will induce the French cider-maker to put upon the English market a drink more suitable to the tastes of the public than that made at home, and if once the foreigner gains the favour of the consuming public, English makers will be unable to oust their more enterprising rivals.

"I believe that, with careful attention to the facts and advice given in this report, cider-makers will be able to compete with any foreign imports, and that, if well made, cider will become a national beverage.

"FREDK. J. LLOYD.

"THE CONSTITUENTS OF APPLES AND APPLE JUICE.

"An apple consists, from the practical cider-maker's point of view, of two parts, juice and marc, or solids not in solution, If the whole of the soluble constituents are extracted, only about 4 per cent. of solids remain; but in ordinary cider-making, by one pressing it is seldom possible to extract more than 75 per cent. of the juice, and by subsequent second treatment about 10 per cent., so that the marc always contains some of the juice. In an unripe apple the proportion of juice is less. The marc then contains substances (pectin compounds) which, during ripening, gradually change into soluble compounds and enter the juice, thus increasing its value for cider, and also changing its character. Hence the necessity of using ripe apples.

"The most important constituent of the juice is sugar. Two kinds of sugar are present, grape sugar and cane sugar; but as both of these are fermentable, their presence has more of a scientific than a practical interest; hence, in using the word sugar, one refers to the total quantity present.

"The acidity of the juice is due to an acid known as malic acid. The quantity of this acid present in apples varies according to the kind of apple. In the juice of some it amounts to over one part per cent. In the juice of others to only 0·1 or 0·2. The quantity present also varies according to season, as may be seen from the average analyses of the juice from press, and this variation does not appear to correspond in any way with the other constituents. Thus, in 1893 and 1894, the average acidity present in the juice of six varieties of apples was the same; yet the solids varied greatly, being 15·7 per cent. and 10·7 per cent. respectively. There is a very widespread opinion that the natural acidity of the apple is much greater in a poor season than in a good one. The results of experiments prove this opinion to be erroneous; but it is found that the apple juice during a poor, wet season, has a tendency to become acid rapidly, and this has probably given rise to the above opinion.

"Tannin is the third substance of importance. It has the property of precipitating albumin, and so helps to clear the juice. Its strong, astringent flavour is marked in some varieties of cider apples, and also in cider made from such apples.

"The juice contains some soluble pectin compounds, a little albumin, and other substances. In this report, these taken together are called 'extractives,' their distinct character not having as yet been determined.

"A small quantity of mineral matter is also present in solution in the juice.

"The Analysis of Apples, Apple Juice, and Cider.

"The quality of cider depends mainly upon two great factors: first, the original composition and condition of the apples and the apple juice; and secondly, the fermentation which takes place in the juice. Before we can satisfactorily discover what are the many causes which influence the composition of the apples and the juice obtained from them, we must have some means of estimating anayltically the composition of the juice.

"The following system has been adopted in these investigations:—Six to ten apples are carefully weighed, and the weight divided by the number of apples taken. This gives the average weight of each apple. The apples are ground in a small machine—a kind of modified sausage machine having been adapted for the

purpose. No very satisfactory machine has yet been found. The pulp is placed in a small hand-press, such as is used for pharmaceutical purposes, and the juice is extracted and weighed. This press is also faulty, as it is difficult to ensure the same pressure being applied to each sample. A press is wanted the screw of which works in a lever, from the end of which a definite weight is suspended. The pulp would then always be submitted to the same pressure, and if this acted for a definite period the results would be as uniform as could be expected.

"The nature of the pulp which remains, and how this varies at different periods in the growth of the apple, has been to a slight extent examined ; but the investigation presents many difficulties. A good description of the substances present in this pulp, and the changes which take place in the ripening of fruit, will be found in Dr. N. Graeger's 'Obstweinkunde.' *

"The analysis of the juice is conducted as follows :—It should be first strained through a moderately fine cloth or muslin. The specific gravity represents the weight of a given volume of juice when compared with the same volume of distilled water. In writing and print it is nearly always abbreviated to Sp. Gr. The temperature of the juice should be exactly 60deg. F. If it is not, then either the juice must be brought to this temperature or a correction made for the temperature by means of a table or by calculation. The most accurate method of estimating the Sp. Gr. is to fill a bottle known to hold exactly 100 grammes, or 1,000 grains, of distilled water with the juice to be tested, and then to carefully re-weigh. The juice, instead of weighing 100 grammes or 1,000 grains, will be found to weigh, say, 106·55 grammes, or 1065·5 grains. If the temperature is 60deg. F., then the Sp. Gr. of the juice is 1·0655; but if the temperature is not 60deg. F., then a correction is made. The most simple correction, and one which is fairly accurate, is when the temperature is below 60deg. F., deduct from the fourth figure of the specific gravity as many points as the temperature is below 60 F. For example: the temperature is, say, 50deg. F., or 10deg. below 60deg. The gravity shown is 1·0655, and from this deduct 10, leaves 1·0645, which is the true Sp. Gr. at 60deg. F. When the temperature is above 60deg. add instead of deducting, the points which represent the difference in temperature. Thus, if the temperature is 65deg. F., we have—

Gravity shown	1·0655
Add for temperature	5
True gravity	1·0660

"A more simple and nearly as accurate method of estimating the gravity is by means of the hydrometer. This instrument should be called the gravimeter ; in America it is called the densimeter. The stem contains a scale graduated from 1,000 to 1,100, and showing 100 divisions. This only gives the gravity to the third

* Published by B. F. Voigt, Weimar, 1895.

decimal place, and therefore corrections for temperature are more difficult to make, but can be made as above described by first adding another 0 to the result obtained and then correcting.

"In taking the gravity of liquids they should be as clear as possible, and contained in a glass cylinder which leaves ample scope for the hydrometer to rise and fall. The hydrometer must be clean, free from grease, and the upper part of the stem dry. It should be inserted into the liquid until nearly as deep as it will subsequently fall; thus, if the gravity is supposed to be about 1·060, insert to 1·050 and then let go. It will fall below the 60, then gradually recover itself, and come to rest. The line which corresponds with the surface of the liquid will represent the gravity. Thus, if it rest at 61 then the gravity is 1·061. Owing to froth it is sometimes difficult to read from above; the hydrometer can then be read from below.

"The gravity of the juice is, by some makers, taken by the saccharometer, an instrument the same shape and used in the same way as the hydrometer, but graduated, and supposed to show the percentage of sugar in the juice. The results obtained with this instrument were found to be most unsatisfactory. As the solids of the juice are composed of several constituents besides sugar, the saccharometer is unreliable.

"A fairly accurate guide to the amount of solid matter in the apple juice may be obtained with the simple hydrometer by the following formula:—Sp. Gr. × 234 − 234. Thus, if the specific gravity be 1·06, multiply by 234 = 248·04, deduct 234 = 14·04, which will be very nearly the percentage of solid matter present in the juice of the apple. The result obtained is not absolutely accurate, being slightly low with a rich juice and slightly too high with a poor juice; but for practical purposes this simple method will be found useful.

"The solids are more accurately estimated by evaporating five cubic centimetres to dryness on a water bath, and drying the residue at 100 deg. C. (212 deg. F.) for a definite time, viz., six to ten hours. I find by experiment that it is not possible to obtain the solids absolutely dry, for if continuously dried they lose weight constantly for several days. It was therefore thought better to carry out a uniform system rather than attempt to obtain an absolute result.

"The acidity of the juice is determined by means of a standard solution of alkali, each cubic centimetre of which is equivalent to 0·01 grammes of malic acid. The indicator used is litmus paper, for the colour of the apple juice prevents any change in a liquid indicator being seen. The apparatus is exactly similar to my acidmeter, now so largely used by cheesemakers. It consists of a graduated burette, into which the standard solution of alkali is poured up to the zero mark. Ten cubic centimetres of apple juice or cider are placed in a white porcelain dish, and the soda solution gradually added from the burette. The cider

changes colour as the acid becomes neutralised. If the glass rod which is used to stir the cider in the dish is brought in contact with a small strip of blue litmus paper it will make a red mark where it touches the paper, but as the acidity gets neutralised by each addition of alkali each new mark gets fainter and fainter, until at last no red can be seen. The acidity of the liquid has been neutralised. If the number of cubic centimetres of alkali used is now noted, this will show the acidity. Thus, if 3·5 cubic centimetres have been taken, then the acidity is 0·35 per cent.

"The Sugar.—There are at present in apple juice at least two varieties of sugar—grape sugar and cane sugar. If the sugar is estimated in the juice by Fehling's method, or Pavy's modification thereof, the grape sugar only is shown. In order to estimate the total amount of sugar it is necessary to convert it all into one variety by heating the juice with dilute hydrochloric acid (1 per cent.) for thirty minutes. The total sugar, including that which is thus 'inverted,' is then estimated by means of Pavy's modification of Fehling's solution. By deducting from this total sugar the amount of grape sugar originally found, we obtain, by difference, the cane sugar.

"The tannin is by far the most difficult substance to estimate, and at present the methods at our disposal for the purpose are not very satisfactory. However, it was necessary to adopt some method, and, after many experiments, the most suitable method appeared to be that of Neubauer. A standard solution containing 0·785 grammes of permanganate of potash per litre is employed. Tannin has the power of decolourising the solution. To determine the exact point of complete decolourisation a solution of indigo is added to the juice as an indicator. The estimations are made as follows:—5 cubic centimetres of apple juice are taken for examination; to these are added five cubic centimetres of indigo solution of such a strength that the five cubic centimetres will be decolourised by exactly one cubic centimetre of permanganate solution. Next, five cubic centimetres of dilute (1 in 10) sulphuric acid are added, and the whole is made up of distilled water to 200 cubic centimetres. To this liquid the standard solution of permanganate is carefully added until the blue colour of the liquid disappears. The quantity of permanganate required (less the one cubic centimetre required by the indigo) gives the amount which has been decolourised by the tannin. In these determinations it is assumed that the tannin present in the apple juice has the composition $C_{14}H_{10}O_9$, and that one cubic centimetre of the permanganate solution is decolourised by 0·001 gramme of tannin. The strength of the permanganate solution must be checked by experiments on pure tannin.

"The alcohol is estimated in 100 cc. of the cider, to which a quantity of carbonate of lime has first been added sufficient to neutralise all the acidity. This is necessary, as otherwise volatile acids would come over. About 70 cc. of liquid is distilled, the distillate made up to 100 cc. brought to 60 deg. F., and its specific

gravity accurately determined in a 50 cc. bottle. The percentage of alcohol present is found by means of the following table:—

Table for the Estimation of Alcohol (Stevenson).

Sp. Gr. of Distillate.	Alcohol by Weight.	Alcohol by Volume.	Sp. Gr. of Distillate.	Alcohol by Weight.	Alcohol by Volume.	Sp. Gr. of Distillate.	Alcohol by Weight.	Alcohol by Volume.
·9880	7·10	8·80	·9890	6·40	8·00	·9900	5·75	7·15
·9881	7·00	8·75	·9891	6·35	7·95	·9901	5·70	7·05
·9882	6·95	8·65	·9892	6·30	7·85	·9902	5·65	7·00
·9883	6·90	8·60	·9893	6·20	7·80	·9903	5·60	6·95
·9884	6·80	8·50	·9894	6·15	7·70	·9904	5·50	6·85
·9885	6·70	8·40	·9895	6·10	7·60	·9905	5·54	6·80
·9886	6·65	8·35	·9896	6·00	7·55	·9906	5·40	6·75
·9887	6·60	8·30	·9897	5·95	7·45	·9907	5·30	6·70
·9888	6·55	8·15	·9898	5·90	7·40	·9908	5·25	6·60
·9889	6·50	8·10	·9899	5·85	7·30	·9909	5·20	6·50
·9910	5·15	6·40	·9920	4·50	5·65	·9930	3·90	4·90
·9911	5·05	6·30	·9921	4·45	5·55	·9931	3·85	4·85
·9912	5·00	6·20	·9922	4·40	5·50	·9932	3·80	4·80
·9913	4·95	6·15	·9023	4·35	5·40	·9933	3·75	4·70
·9914	4·90	6·10	·9924	4·25	5·30	·9934	3·65	4·65
·9915	4·80	6·00	·9925	4·20	5·25	·9935	3·60	4·55
·9916	4·75	5·95	·9926	4·15	5·20	·9936	3·55	4·50
·9917	4·70	5·90	·9927	4·10	5·15	·9937	3·50	4·45
·9918	4·65	5·80	·9928	4·00	5·05	·9938	3·40	4·30
·9919	4·55	5·70	·9929	3·95	5·00	·9939	3·35	4·25
·9940	3·30	4·15	·9950	2·75	3·50	·9960	2·15	2·70
·9941	3·25	4·10	·9951	2·70	3·40	·9961	2·10	2·65
·9942	3·20	4·00	·9952	2·60	3·30	·9962	2·05	2·60
·9943	3·15	3·95	·9953	2·55	3·20	·9963	2·00	2·50
·9944	3·10	3·85	·9954	2·50	3·15	·9964	1·95	2·45
·9945	3·00	3·80	·9955	2·45	3·10	·9965	1·90	2·40
·9946	2·95	3·75	·9956	2·40	3·00	·9966	1·85	2·30
·9947	2·90	3·70	·9957	2·35	2·90	·9967	1·80	2·20
·9948	2·85	3·60	·9958	2·30	2·85	·9968	1·75	2·15
·9949	2·80	3·55	·9959	2·20	2·80	·9969	1·65	2·05
·9970	1·60	2·00	·9980	1·05	1·30	·9990	0·55	0·65
·9971	1·55	1·95	·9981	1·00	1·25	·9991	0·45	0·55
·9972	1·50	1·85	·9982	0·95	1·20	·9992	0·40	0·50
·9973	1·45	1·80	·9983	0·90	1·10	·9993	0·35	0·45
·9974	1·40	1·75	·9984	0·85	1·05	·9994	0·30	0·40
·9975	1·35	1·70	·9985	0·80	1·04	·9995	0·25	0·30
·9976	1·30	1·65	·9986	0·75	0·90	·9996	0·20	0·25
·9977	1·25	1·55	·9987	0·70	0·85	·9997	0·15	0·20
·9978	1·20	1·45	·9988	0·65	0·80	·9998	0·10	0·15
·9979	1·20	1·40	·9989	0·60	0·70	·9999	0·05	0·05

"A rapid method of estimating the alcohol, which is of value where large numbers of samples have to be analysed quickly, as at shows, may here be mentioned. It is not absolutely accurate, but if carefully carried out gives fairly accurate results. It is based upon this fact: The specific gravity of a sample of cider depends

upon two factors—the percentage of solids in solution which raises the gravity, and the percentage of alcohol which lowers it. If the specific gravity of the cider is taken, then the alcohol evaporated off by boiling the liquid down to about one-third its volume, making up to the original volume, and again taking the gravity, the difference between these two gravities is due to the alcohol; but the alcohol cannot be determined simply by deducting the one gravity from the other. The method of procedure is as follows:—

"Divide the specific gravity of the cider by the specific gravity of the liquid left after evaporating the alcohol: the resultant or quotient represents the specific gravity of the alcoholic distillate which has passed off. By the table on page 362 it is easy to discover what percentage of alcohol this represents. The following is an example of this method. The original cider had a gravity of 1·0369; the liquid left after evaporating the alcohol had a gravity of 1·0422. By dividing the former by the latter we obtain the result, ·9949, which, by our table, represents 3·55 per cent. of alcohol by volume.

"By distillation this cider yielded 3·60 of alcohol by volume, showing that the method is fairly accurate.

"If the solids in cider were of uniform composition, we could determine by calculation what would be the specific gravity of the liquid freed from alcohol from the solids. I find that this cannot be done with absolute accuracy, but the following formula has given very satisfactory results, where S. represents the solid matter per cent., then—

$$\text{Specific gravity of cider freed from alcohol} = 1{\cdot}0100 + S - 2\,[{\cdot}0039].$$

For example, a cider contains 7 per cent. of solids, the gravity of the liquid when freed from alcohol would be—

$$\begin{array}{rr} & 1{\cdot}0100 \\ 7 - 2 = 5 \times {\cdot}0039 = & {\cdot}0195 \\ \hline & 1{\cdot}0295 \end{array}$$

A table may be made to represent the gravity equivalent to each per cent. and decimal of a per cent. of solids.

"The albumen may be precipitated in the clear liquid by bringing this to nearly boiling point. It is then filtered off on a tarred filter, and weighed. The solution is then evaporated to a small bulk, and alcohol added. This precipitates the pectin. I have found these determinations difficult and unsatisfactory.

"The solids are burnt over a low flame. It is not easy to obtain a good white ash.

"THE DETECTION OF PRESERVATIVES.

"The detection of salicylic acid in cider presents some difficulty.

"Attempts to trace this acid were first made on the residue left after distilling the alcohol, by making this slightly acid and extracting with ether. The ether solution took up colouring matters and also tannin, or similar compounds, and the characteristic

colour reaction given by salicylic acid with ferric chloride solution could not be obtained. Several solvents, both alone and combined with ether, were tried, but only rarely could any colour reaction be obtained, and then it was not a satisfactory one. A series of experiments on cider, to which definite quantities of salicylic acid had been purposely added, proved that all the usual methods failed in detecting its presence. It then occurred to me that it might be possible to distil the salicylic acid in a current of steam; and an experiment proved that when it was present in considerable quantity sufficient came over for the distillate to give the characteristic colour with ferric chloride solution. My next experiments were directed to discover whether the salicylic acid could be thus obtained without passing steam through the liquid, but by merely boiling. The results were satisfactory.

"Hence the method adopted was to take 100 cc. of cider, make alkaline with soda, and distil off the alcohol (50 cc. is sufficient). The residue was then made acid with sulphuric acid, and distillates of 10 cc. taken off and marked 1, 2, 3, 4. These were tested with 1 per cent. solution of ferric chloride. It was then found that sometimes the first distillate, or even the first two, would not show any colour reaction, but only the third, or perhaps the fourth; and it soon became evident that this depended on the quantity of salicylic acid present.

"Quantitative experiments were next made, and when operating on 100 cc. of liquid the following results were obtained:—The presence of 1 part of sodium salicylate in 10,000 parts of cider could be detected in the first distillate generally, and certainly in the second; the presence of 1 part in 20,000 was visible in the second or third distillate, and of 1 part in 30,000 in the third or fourth distillate. If present in smaller quantities it could not be detected when working with 100 cc., though by concentrating a larger bulk of cider it would be possible to detect even smaller quantities. However, as five grains to the gallon can be found with certainty, and as less would scarcely act as a preservative, it is seldom necessary to work on a larger volume than 100 cc.

"In 1900 this method was applied to the samples exhibited at the show at Bath. To my surprise no less than 20 out of 84 exhibits gave the colour reaction of salicylic acid. Without letting the exhibitors know the result of my analyses, one or two were questioned by the steward as to whether they had not used some preservative or anti-ferment. They so stoutly denied having done so that it was decided not to take any action, and mainly for two reasons. It was thought, first, that it might be possible for salicylic acid to be naturally present in apple juice, and, secondly, that my method of analysis might be faulty, or the results be due to some substance other than salicylic acid. Repeated examinations have been made of cider known to be genuine, and I have not been able to find any salicylic acid naturally present in apple juice, nor produced by fermentation in juice which was known to be free from added matter. It was possible that other compounds might pro-

duce the same reaction as salicylic acid, therefore experiments were made to determine whether this was so.

"Phenol, which itself gives a somewhat similar reaction, when added to cider (even in comparatively large quantity) and distilled, gives no colouration. Saccharin—which can be decomposed, and produces salicylic acid under certain conditions—might possibly be so decomposed by the treatment with soda. Experiments have proved that this is not the case. I then tried whether fermentation proceeding in a liquid containing saccharin might bring about decomposition, but after fermentation these samples were tested, and no salicylic acid could be discovered. To make quite certain that I had left no possible means untried of proving the substance which I had found in these exhibits to be salicylic acid, I wrote to Professor H. Armstrong, F.R.S., who suggested that the bromide compound might be examined. This substance crystallises in a very characteristic manner, and I found that even in most dilute solutions, like these distillates, the crystals were formed, and could be centrifugally separated and distinguished when examined under the microscope. One somewhat interesting fact was observed during the continuance of these observations, namely, that solutions containing salicylic acid are liable to decomposition by the growth of certain fungi, and that in due course the whole of the salicylic acid disappears.

"THE SEASONS—1893 TO 1902.

"1894.—A late frost in the spring cut off the blossoms of the apple trees, and so caused the apple crop to be exceedingly small. The year was one characterised by little sunshine and much wet. Two results followed the want of sunshine and the excessive rains: one was that the apples during October and November did not properly ripen on the trees, and the other that it was not possible to store them in hurdle stores, to ensure subsequent ripening. The effect of the bad season on the composition of the apples was very marked, as may be seen from the following table:—

Composition of Apple Juice.

Variety.	1893.			1894.		
	Sp. Gr.	Solids.	Acid.	Sp. Gr.	Solids.	Acid.
New Cadbury	1·0574	14·0	·16	1·0415	9·14	·16
Tom Hooper	1·0632	15·4	·72	1·0520	11·38	·70
Red Jersey	1·0680	16·5	·20	1·0470	10·72	·19
Kingston Black ...	1·0680	16·5	·32	1·0500	11·34	·44
Royal Somerset... ...	1·0550	13·5	·60	1·0435	9·48	·71
Gins	1·0750	18·1	·39	1·0526	12·06	·23
Average	1·0644	15·7	·40	1·0477	10·70	·40

"The amount of total solids in the juice was no less than 5 per cent. lower in 1894 than it was in 1893. This 5 per cent is

sugar. Hence the juice from which the cider had to be made in 1894 contained one-third less fermentable material than in 1893.

"The next point to be noted is that the average amount of acid present in these apples is the same in both years.

"1895.—This was a better year than 1894, but not so good as 1893, as regards conditions favourable to the apple crop. The season was a plentiful one, and the apples were of fair quality, better than in 1894, but not so good as 1893. This is seen from the table on p. 369, which gives the average composition of the juice from the press for the 10 years during which the observations have been in progress, and these figures prove that in 1895 the quality of the apple juice in bulk fell considerably below that of 1893.

"1896.—This year was characterised by bright sunshine, a high temperature, and an exceptionally small rainfall. There was only a small apple crop. The season was an early one, that is to say, the apples ripened sooner than usual. The apples yielded less juice per 1,000lbs. weight than was obtained in 1895. Thus, in 1895, 1,000lbs. of apples yielded 650lbs. of juice, while in 1896, from the same weight of apples, only 615lbs. of juice were obtained; but if the juice was less in volume it was better in quality, as shown in the table of average composition of juice from press, p. 369. The composition of the juice was nearly as good as in 1893 with respect to total solids, and was better than in 1893 in not being quite so acid. How much better it was in 1896 than 1895 may be estimated by comparing the average specific gravity of the apple juice from each 'cheese' made in these years. This in 1895 was 1·0534, in 1896 it was 1·0625. In other words, in 1895 the juice contained about 11 per cent. of fermentable sugar, capable of yielding $5\frac{1}{2}$ per cent. of alcohol; in 1896 it contained about 13 per cent. fermentable sugar, capable of yielding $6\frac{1}{2}$ per cent. of alcohol.

"1897.—The characteristics of the season were a more than average amount of sunshine, especially during the month of October, an exceptional rainfall in August, a low temperature combined with a large rainfall in September, and an exceptionally high temperature in October. The effect of the season upon the apple crop varied greatly in different localities, in some districts the crop being very small. The effect at Butleigh may be gathered from the following figures:—

"The total volume of juice yielded was about 3,000 gallons, as compared with 1,000 gallons in 1896 and 9,000 in 1895. The yield of juice per 1,000lbs. of apples was 616lbs., as compared with 615lbs. in 1896, and 650lbs. in 1895. The characteristic of the apple juice in 1897 was a high percentage of acid, while the total solids were higher than in 1895, but below those of 1893 and 1896.

"1898.—This was a season of very small rainfall, warm air temperature, and varying sunshine. The effect of the season upon the yield of apples was injurious, there being a much smaller yield than the average. As regards the quantity of juice which these apples yielded the effect was not striking; 1,000lbs. of apples yielded

621lbs. juice, which is only 6lbs. more than was obtained in 1896, and 5lbs. more than was obtained in 1897. The average quality of the juice was better than in 1897, though not so good as in 1896 or 1893. The apples of 1898 were all much smaller than in 1897 or 1896. These apples, in most cases, also produced a smaller percentage of juice. Hence the quality of that juice was, as a rule, better than in 1897.

"1899.—The period of growth of the apple crop in 1899 was both dry and warm, there had been no frosts in the early part of the season to destroy the blossoms, and the result was a fairly good crop. The weather was such as to insure the apples being fully ripe. For not only was the period of bright sunshine very considerably above the average, but the air temperature during the months of August and September, in which months probably the greatest development of the apple occurs, was also far above the average in spite of the heavy rainfall of the latter month. The combined result of these conditions was more marked upon the composition of the apples than upon the quantity of the crop. The apples yielded not only more juice but juice of better quality than in any former year of the observations. Thus, as regards the quantity of juice, 1,000lbs. of apples yielded 654lbs. of juice. This was the highest recorded yield of juice since 1895, when it was first estimated. In that year the yield was 650lbs., while in 1896, 1897, and 1898 it was only 615, 616, and 621lbs. respectively. The quality of the juice was also better than any which had been obtained since 1893; this is somewhat remarkable considering the volume. In 1895 the large volume of juice was of poor quality, with a specific gravity of only 1·052; but the average specific gravity of the juice during the season 1899 was 1·061, which is even higher than that of 1893. The high proportion of solids in the juice was accompanied by a small proportion of acid. Thus, the season of 1899 yielded a juice of exceptional quality, which resulted in the production of excellent cider.

"1900.—The chief characteristic of the season was the small amount of rain during July, August, and September. Then came a heavy rainfall in the month of October, which caused the fruit to fall on to the damp soil amid the leaves of a rapid autumnal change. The want of moisture in the early part of the season seemed to check the growth of the apples, and they remained, and were at the time of being gathered, exceptionally small. As a rule small apples yield a rich juice; but this year was an exception; the juice was not so rich as one would have expected.

"The average composition of the juice from press was slightly below that of 1899. The apples yielded a high percentage of juice, 1,000lbs. of apples giving 692lbs. of juice, the highest proportion yet recorded. Some of the apples used in this experiment were in fair condition, but the majority, like most of the apples that season, were undoubtedly moist, and this may partly account for the high proportion of juice. That the effect of the season upon the apple crop is marked, irrespective of district and variety, is well shown

by the following extract from a letter sent me by Mr. H. L. T. Blake, of Fairfield, Bridgewater:—'The summer of 1899 was very hot and dry, and in consequence of there being no rain when or after the fruit was forming, there was no natural thinning of the crop. The apples, therefore, in many orchards were thick in clusters on the trees, and were very small in size. Notwithstanding that, they ripened well; and in the thirteen cheeses I put up in 1899 the specific gravity of the juice as it came direct from the press averaged 1·068. On referring to my notes for the year 1900, I find that, although the summer of 1900 was as hot and dry as 1899, the specific gravity of the juice of last year's apples, though grown from the same orchards, ranged from 1·052 to 1·060, representing an average of only 1·057, as compared with 1·068 in 1899. The season, therefore, had more marked effect on the apples at Fairfield than on those at Butleigh.

"1901.—The season was one of small rainfall, with high temperature, and during the months of April, May, and June of more than usual bright sunshine. Towards the end of the ripening season there was, however, less sunshine than there had been during the previous two years. The apples, consequently, ripened more slowly than had been expected, and the crop was not large.

"The total yield of the apples at Butleigh was about 6,000 gallons of juice. The apples on an average were not quite so small as in 1900, but individual varieties varied greatly in size as compared with former years, some being much smaller, others much larger. The percentage of juice was high when working on the bulk, 1,000lbs. of apples yielding 690lbs. of juice. It will be seen that while the specific gravity of the juice was not so high as in the two previous seasons, it was as high as it had been since 1893. The most marked peculiarity of the juice was its low acidity.

"The following tables summarise some of the most important factors regarding the seasons during which the experiments were conducted:—

Rainfall—Inches over or under Average.

—	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
July ...	+ 1·29	+ 1·79	— 0·08	— 1·38	— 1·54	— 2·77	— 1·73	— 1·84	— 1·47	— 0·87
August ...	— 1·05	+ 0·27	+ 0·08	— 0·88	+ 3·18	— 0·38	— 2·20	— 0·41	— 1·32	+ 0·24
September	— 1·69	— 0·67	+ 1·91	+ 2·01	+ 0·67	— 1·90	+ 0·98	— 2·29	— 0·46	— 0·94
October ...	— 1·18	+ 0·68	— 0·26	— 0·89	— 2·47	+ 1·84	— 0·90	+ 0·40	— 1·33	— 1·06
	Air Temperature—Degrees Fahr., above or below Average.									
July ...	+ 1·85	— 0·10	— 0·2	+ 0·9	+ 2·6	0·0	— 1·2	+ 2·7	+ 2·6	— 2·0
August ...	+ 3·5	— 1·3	— 0·05	— 1·5	+ 0·9	+ 2·5	+ 2·8	— 0·1	+ 0·2	— 1·0
September	— 0·3	— 2·05	+ 4·55	— 0·2	— 1·7	+ 3·8	+ 4·4	0·0	+ 0·8	— 1·5
October ...	+ 1·0	+ 1·15	— 3·4	— 2·8	+ 3·3	+ 4·5	+ 2·3	+ 2·7	+ 1·6	+ 1·6
	Bright Sunshine—Hours above or below Average.									
July ...	— 12·2	— 37·0	— 3·9	+ 19·6	+ 48·1	+ 44·7	+ 50·9	+ 82·7	+ 12·6	+ 9·9
August ...	+ 42·9	— 61·4	— 10·2	+ 6·0	— 3·6	— 5·9	+ 115·8	+ 20·9	+ 29·1	— 46·3
September	+ 22·8	+ 7·0	+ 77·1	— 42·6	+ 7·7	+ 56·7	+ 57·0	+ 36·0	— 29·8	+ 20·4
October ...	+ 20·2	— 21·2	— 6·0	+ 4·8	+ 29·3	— 26·1	+ 30·5	+ 31·2	— 16·9	— 26·2

"THE INFLUENCE OF SEASON ON APPLES AND THE APPLE CROP.

"Upon this very large and intricate subject it is only possible to make a few statements which at present seem justified from the observations at Butleigh. The composition of the apple is greatly affected by the season, but how and why is a problem which I have not as yet attempted to investigate. I here point out some of the evidences of this effect because the subject is worthy of investigation. So also are the changes in composition due to locality; that is to say, due to soil, as distinct from climatic conditions. Not that we can alter either the one or the other; but the more thoroughly we understand the processes of nature the more mastery we shall obtain over the products which are the results of such processes. The yield or crop varies from year to year. Most people may have noticed that, as a rule, an exceptionally prolific year of any one fruit, like the apple, is followed by a season of exceptional scarcity. The apple crop of 1896 confirmed this general rule, for while 1895 was a most prolific year, in 1896 many cider makers found a difficulty in obtaining sufficient apples to make any cider at all. The same is true of individual apple trees. As a rule, those which yield heavily one year yield but slightly the following year. Hence, in estimating the value of a particular variety of apple the yield of that variety cannot be determined upon the result of one season only, but requires that the average of several should be taken. The chief cause of a small crop has been a late frost in the spring, as in 1894. The second cause would appear to be a dry season, and inability of the trees to obtain sufficient moisture or sap to fully form the apples.

"THE COMPOSITION OF THE JUICE VARIES ACCORDING TO THE SEASON.

"This is best seen by the following table, showing the average composition of the juice obtained at Butleigh from practically the same orchards year after year:—

Average Composition of Juice from Press.

Year.	Number of Samples.	Sp. Gr.	Solids.	Acid.
1893	6	1·060	14·40	·63
1894	11	1·050	11·14	·60
1895	13	1·052	12·24	·46
1896	5	1·057	14·02	·40
1897	5	1·053	13·26	·68
1898	5	1·056	13·62	·51
1899	14	1·061	15·57	·44
1900	54	1·059	...	...
1901	12	1·057	14·43	·34
1902	8	1·047	11·43	·53

"Want of sunshine towards the end of the season causes the apples to ripen slowly, so delaying the manufacture, and also tends to diminish the crop. This was noticed in 1901, as compared with 1899 and 1900. If this lack of sunshine is accompanied with heavy rain the apples do not appear to ripen properly on the trees. This was remarked in 1894. It is probably best under such conditions to gather the apples and ripen them in store. In 1902 the low temperature and want of sunshine not only prevented the apples from ripening, but caused the juice to contain a larger proportion of 'extractives' than in any former year.

"Passing from the crop as a whole to individual varieties of apples, it would appear that the season does not affect all varieties of apples alike; a season suitable for one variety is not suitable for another. This is well illustrated by the following facts:—The apples Kingston Black, New Cadbury, and Butleigh No. 14, yielded in 1898 a juice of higher specific gravity than in 1899, while Chisel Jersey and Red Jersey apples did the reverse. Evidently, the cider maker in any attempt to improve his orchards by reducing the number of varieties of apples must not overlook this important consideration.

"Apples of the same variety and from the same tree vary each year; (1.) In average size or weight; (2.) in the proportion of the juice which they yield; and (3.) in the gravity of the juice. It is somewhat remarkable that the proportion of juice does not appear to depend upon the average size, for small apples will at times give a large, at other times a small, proportion of juice. Most frequently the gravity of the juice appears to increase as the size of the apple decreases, but this is not invariable. Thus, while in nearly all instances the average weight of the samples in 1898 was below that of the same variety in 1897, yet in many cases the composition of the juice of these smaller apples was almost the same as that of the larger apples produced in 1897."

ONION CULTURE.

Selection of Soil.

A judicious selection of soil is of greatest importance. The profit or loss of the business depends largely upon whether the soil contains a combination of conditions especially conducive to the proper development of the plant, or such as will enfeeble it in every state of growth. The mechanical condition of the soil should first be considered. Heavy clay lands should be avoided, because they are difficult to plough and cultivate, usually deficient in organic matter, and often improperly drained. It is impossible to prepare

them for the seed or plants as early in the spring as is desirable; and the surface bakes and cracks after the rain, unless stirred just at the proper time; besides, the plants will not bottom freely or ripen properly in heavy soils, and tend to produce scallions. Lands in which sand largely predominates should not be selected, because of their incapacity to resist drought and to retain the fertilisers applied. Gravelly soils are objectionable for the same reasons. The gravel also, if very large, forms an impediment to the wheel-hoe and hand weeder. Very stony soils can never be profitably used for onions.

Soils abounding in decomposed vegetable matter are generally most valuable for the cultivation of onions. It is on such soils that the largest plantations are found. An Ohio firm annually tills about 400 acres of black muck. A gardener in Santa Clara County, Cal., states that in his section great quantities of onions are grown on black adobe, some on deep sandy loam, and some on reclaimed tule land, which is much like pulverised bog or peat. This last-named soil has never been fertilised, and continues to produce well, although it will probably need enriching in the course of time. Similar soils have been used largely in New York, Michigan, Connecticut, and other States. It is valuable because of its loose mechanical condition, abundance of plant food, and ability to retain an abundant supply of moisture.

Most farmers, however, who contemplate engaging in the production of onions own their land, and do not desire to sell and locate where soil is, perhaps, more favorable to the growth of this crop. Under such circumstances if rich, deep friable loam can be found on the farm, it should be selected for onions. A fair amount of sand is an advantage if the soil is sufficiently retentive to resist drought and to hold the fertilisers applied. Clayey soils, if not too tenacious, may be used with satisfactory results, provided the proper attention is given to cultivation.

Many soils which are properly drained might prove valuable for onion culture if a few lines of tile were laid to carry off the surplus water. Hilly locations should not be selected, because of their tendency to wash, thus exposing some bulbs and burying others. Soils which have been heavily cropped for a series of years, with very light applications of manures, cannot be profitably cultivated in onions without first restoring the supply of plant food which has become exhausted. Poor soil will not produce good onions, and it requires several years to bring such soil into condition for the successful culture of this crop.

Fields which have been overrun with weeds should be cultivated in hoed crops for a series of years to destroy the seeds, which would otherwise germinate and greatly increase the cost of cultivating and weeding the onions.

The onion may, by liberal fertilising, be grown on the same ground year after year with increasing yields. Continuous culture, however, should not be followed in localities where diseases and

insects are prevalent. In such cases strict rotation should be followed.

Soils which afford natural advantages for irrigation should not be overlooked. In seasons when the rainfall is not sufficient to supply necessary moisture for the growing crop, irrigation will prove highly beneficial. The light soils of many creek and river bottoms, which are rich in organic matter, might be irrigated at a small cost by means of dams and ditches, or, in some cases, by pumps operated by windmills, water-wheels, or engines.

Preparation of the Soil by previous Cropping.

Soils which are stiff and heavy, which contain too much sand, which abound in pernicious weeds, or are deficient in fertility, may be greatly improved by the cultivation of one or more crops previous to planting onions. A favourite practice in some sections is to sow clover, and after the first crop is cut for hay the second growth is allowed to rot on the field, and, with a heavy dressing of stable manure, is ploughed under in the fall. The following spring the ground is planted in potatoes, and the next year onions are grown. Such a course of treatment leaves the soil in excellent condition. The land is improved by the application of manure and the decomposition of the clover roots and tops, while the nitrogen supply is increased both by means of the clover, which gathers this element from the atmosphere, and by the manure. The effect of such treatment is to enrich the soil, make it loose and friable, and free it from many weed seeds. Crimson clover could be used to advantage in States where this legume thrives, since, when ploughed under, it produces the same effect as red clover.

Cowpeas are used as a substitute for clover in the South. The peas may be sown in July or August, after a crop of early potatoes has been removed. The dead tops are ploughed under later in the fall, with a liberal dressing of barnyard manure. If either cowpeas or clover is used, and followed the next year by some hoed crop which does not impoverish the soil to any considerable extent, the land is put in the best condition for raising onions. Carrots are said to be the most desirable crop to precede onions. Corn and potatoes, however, are not objectionable. Of course, more plant food should be applied than these crops remove, so that the soil will be constantly improved.

Fertilising.

The onion requires a liberal amount of plant food in the most available form. The quantity and quality of manures which would make potatoes, cabbages, tomatoes, or many other garden crops profitable, will not give even a fair compensation in onion culture, unless favoured by soils highly fertile in their natural state. Beginners fail more frequently, perhaps, from lack of appreciation of this fact than from any other cause. The most expensive item in onion culture is labour. A prominent grower estimates that it costs £25 per acre to start the seedlings, prepare the soil, transplant, cultivate, weed, and pull the crop, when the "new onion

culture" is adopted. The cost of labour is just as great for a crop of 500 bushels as for 1,000. Hence it is judicious for the onion grower to be liberal in the use of fertilisers. If the supply of fertiliser is limited it will pay better to manure one acre thoroughly than two sparingly.

Barnyard manure is indispensable in the production of superior bulbs, unless the soil naturally contains a large amount of humus (decomposed vegetable matter). Muck soils, such as are referred to on a previous page, may be properly treated with concentrated commercial fertilisers alone; but nothing can be entirely substituted for barnyard manure on other soils with as satisfactory results. Hen manure is very highly esteemed by onion growers because of its high percentage of fertilising constituents. Next to this manure, that from the pigsty is considered most valuable, although rotten barnyard manure of any kind gives good results. It is customary to deposit the manure in large piles where it can undergo fermentation, or to compost it with other materials. From 40 to 75 loads per acre should be applied if a large yield is expected. It should be spread evenly over the surface just before ploughing in the fall or early spring, a manure spreader being valuable for this purpose.

Hen manure will produce the best results when added as a top-dressing before planting. Poultry droppings should be dried and pulverised before broadcasting. Specially prepared composts should also be spread after ploughing, and thoroughly mixed with the surface soil by harrowing. A common practice near large cities is to secure nightsoil and compost it with barnyard manure, muck, or loam. This makes a valuable top-dressing. Care should be exercised that all the manures used are free from weed seeds.

We may learn something on the question of fertilising by studying the composition of the onion. An analysis made by the Connecticut Experiment Station of white globe onions showed that 2,000 pounds of mature bulbs contain 2·70 pounds of nitrogen, 0·92 pounds of phosphoric acid, and 2·09 pounds of potash. The average legal weight per bushel in different parts of the Union is about 56 pounds. A yield of 800 bushels per acre is frequently reported. A crop of this size (44,800 pounds), therefore, would remove from an acre of soil 60·48 pounds of nitrogen, 20·61 pounds of phosphoric acid, and 46·82 pounds of potash.

This shows that the onion removes the three essential fertilising constituents from the soil in large quantities, and these must be supplied to the soil if it does not already contain them. Soils which have been freely cropped with clover, cowpeas, or other leguminous plants are not likely to be deficient in nitrogen, although light dressings of the quick-acting nitrate of soda may often be profitable on such soils. Potash and phosphoric acid, however, must usually be applied more liberally. Sometimes one and sometimes the other of the three principal fertilising constituents—nitrogen, phosphoric acid, and potash—is deficient in the soil. It is important for each grower to study the special requirements of his soil. A few experiments with concentrated fertilisers

will settle many doubtful points. It is impossible to supply the needed fertilisers in the proper proportions without first acquiring a fair knowledge of the fertilising constituents already in the soil.

Of the nitrogenous commercial fertilisers, nitrate of soda is the most largely used. It contains about 15 per cent. of nitrogen. This salt is readily soluble, and exceedingly quick in its action. It should never be applied in the fall or winter, because a large amount of the nitrogen would be washed out of the soil before the growing crop required it. From 200 to 400 pounds, applied in four equal dressings, is sufficient in most cases. The first application should be made just before seeding or planting, and mixed with the surface soil by harrowing. The other dressing may be given at intervals during the growing season, carefully broadcasting the salt. Ammonium sulphate, dried blood, and wool refuse, which are also nitrogenous fertilisers, are occasionally substituted for sodium nitrate, and soot is sometimes used with advantage.

To supply the potash, wood ashes are frequently employed. They have the additional advantage of improving the mechanical condition of the soil, making it loose and friable. Either leached or unleached ashes may be used with satisfactory results, the latter being more valuable on account of their larger content of potash—5 to 10 per cent. From 6 to 8 tons of unleached or 10 to 14 leached ashes is a liberal supply. Ashes should be drilled or harrowed in after ploughing. If ashes are not available, or if the expense of transportation is excessive, the grower will find potash salts, such as kainit and muriate of potash, valuable fertilisers. They are applied in the fall, winter, or early spring. The soil will retain the potash until the plants require it, so that the loss by drainage is exceedingly small. Kainit contains 13 to 14 per cent. of potash, and the muriate about 50 per cent. About 200 to 300 pounds per acre of the muriate, or 800 to 1,000 pounds of kainit, is a sufficient application. They should be sown broadcast after ploughing, and harrowed in or distributed by means of a fertiliser drill. A few hundred pounds of bone meal or other phosphates will be beneficial, if phosphoric acid is needed.

The manures applied are never completely taken up by the growing crop. This makes it necessary to supply more than is actually needed. In the cases of the potash and phosphoric acid, for which the soil has a strong retentive power, the excess will remain to benefit succeeding crops.

Other manures may be used with profit in certain parts of the country. Specially prepared fertilisers are largely employed by many extensive and highly successful growers.

Ploughing, Harrowing, and Rolling.

Fall ploughing is preferable in most parts of the country, but it should be deferred as late as possible. Any manure which has been previously applied should be short enough to allow the plough to turn it entirely under the surface. The character of the soil will determine the proper depth for ploughing. If the land is rich,

loose, and friable to the depth of 10 or more inches, there is little danger of ploughing too deep. It is never desirable to turn up a stiff heavy subsoil in preparing ground for onions, for this invariably diminishes the yield, renders cultivation more difficult, and requires more frequent tilling. Fall ploughing is especially desirable with new soils, pastures, and clover sods. It hastens the decay of vegetable matter, and the alternate freezing and thawing of winter and early spring thoroughly pulverise the soil. The ground, also, can usually be worked sooner in the spring, which is a great desideratum in sections where it is important to sow the seed or set the bulbs at the earliest possible date.

No labour necessary to put the soil in a thoroughly fine condition should be spared. A disc harrow is almost indispensable if clods and lumps are numerous. The roller and this implement may be used alternately with advantage. A disc harrow which contains a large number of small discs is excellent to follow one with larger discs, but the ordinary smoothing harrows will answer the purpose on many soils. After thorough harrowing, a plank drag should be employed to level the surface and make it smooth for planting. With the many improved cultivating implements at the gardener's command it is not necessary to use the rake on plats larger than the kitchen garden.

The Seed.

It is impossible to secure satisfactory results without seed of superior quality. Growers sometimes make the mistake of purchasing seed of uncertain vitality because it is cheap. The cost of seed is a small item compared with the other expenditures necessary for a profitable crop, and an attempt to reduce the cost of production by purchasing inferior seed is always injudicious.

Several methods are employed to determine the vitality of onion seed. Actual planting in the hotbed or greenhouse is frequently employed. Another plan is to place a few seeds on a woollen cloth, or moist cotton, and to note the number germinating.

Although these methods will answer the purpose, the most reliable results are obtained by the use of some of the devices commonly used in testing seeds, such as the Geneva tester. Of course, any preliminary test can only approximate the truth. The cold, moist condition of the field may cause a much smaller percentage of germination than the test shows. Previous to purchasing, however, it is advisable to secure sample packages of the varieties desired from half-a-dozen or more reliable dealers and carefully test the seeds. The results will at least indicate the firm which it is safest to purchase.

Varieties.

Varieties which are grown successfully in this country are divided into two classes, namely, American and foreign types, the latter frequently called Italian or Spanish sorts. As American varieties keep longer and are better adapted to most States than those of foreign origin, they are extensively cultivated.

Varieties should be selected which contain the greatest number of desirable characteristics, or command the highest prices in the market for which the crop is to be grown. The best type for general purposes is a bulb of considerable size, as nearly globular in form as possible, hard and compact in structure, mild and sweet in flavour, with close, thin, and fine skin, and small neck. It should also be bright and handsome in appearance, productive, and of superior keeping quality.

It is important for each grower to carefully study the many varieties in cultivation, investigate the market to be supplied, and then make an intelligent selection of those sorts which it is thought will yield the greatest return under existing conditions.

Description of American Varieties.

Danvers (Danvers yellow, round yellow Danvers, yellow globe Danvers).—The most largely grown of the yellow onions, being produced in immense quantities for shipping purposes. It is very productive, giving much larger yields than varieties which form flat bulbs. Four hundred to 600 bushels per acre from seed sown in the field is a very common yield, while 800 to 1,000 bushels are sometimes harvested. The bulbs are very solid, large when given the proper attention, compact, and of excellent flavour. This variety commands higher prices than red onions in most markets.

Extra Early Red.—On account of its earliness in maturing, this variety is valuable in many sections. The bulbs are rather small, flat in shape, and good keepers. It is especially well adapted to cold, mucky soils, and is largely used in the production of sets.

Egyptian (winter onion, perennial, or tree onion).—An unusually hardy variety in the colder States, remaining in the ground with safety all winter. It starts early in the spring, and may be bunched and marketed several weeks before any other variety. The quality is inferior, but the bulbs may be readily sold when better varieties are wanting.

Red Globe and Yellow Globe (Southport).—These varieties closely resemble the white globe, except in colour.

Potato Onion (Yellow and white multiplier.)—The potato onion is most largely grown in southern localities. The yellow variety has been in cultivation for many years, while the white sort is of much more recent introduction. The bulbs are thick, compact, tender if eaten soon after pulling, and very mild and sweet in flavour. Fall planting is generally resorted to with this variety, the sets being placed in drills four or five inches deep. As the name "multiplier" indicates, if a large bulb is planted, division occurs during the season of growth, resulting in the formation of from three to ten or more bulbs from the parent. If sets are planted, they will make single large onions, but not multiply. The plants begin active growth very early in the spring, and may be bunched and marketed at a good profit, or may be allowed to mature. In the milder sections of the South the potato onion will grow during the entire winter. The mature bulbs should be stored in thin layers in a dry

apartment to insure their keeping. This variety is rarely, if ever, affected by the onion maggot. From the fact that the small bulbs increase in size, and the large ones multiply, it is necessary to plant both sizes in order to secure onions for market and also maintain the stock.

Shallots.—Shallots are frequently mistaken for the potato onion. They differ from it in throwing up an occasional seed shoot and in the bulb always multiplying, which is not true with small potato onions. The bulbs are more oblong in shape than the potato onion. Shallots are small, may be kept the year round, and possess a mild, pleasant flavour.

Silver Skin (White Portugal, Philadelphia white).—A variety largely used in the production of the white sets sold by seedsmen. The bulbs are handsome, medium sized, and of excellent flavour. It commands higher prices than the red or yellow sorts, but is not so productive nor so easily wintered unless thoroughly cured. The smaller bulbs are popular for pickling.

Wethersfield (Wethersfield red, large red Wethersfield).—The most extensively grown red sort. It rivals the yellow Danvers in many portions of the country. Some markets prefer it to that variety. The bulbs are large, growing to six to eight inches in diameter in especially favourable localities. It is very productive and a good keeper. The bulbs are somewhat flattened in form, in this respect being inferior to the yellow Danvers. The skin is deep purplish-red, the flesh purplish-white, rather coarse, and of stronger flavour than that of the yellow onions.

White Globe (Southport white globe).—The perfect globe shape and smooth white skin make this one of the handsomest onions. It always commands good prices, but requires more care cultivating, harvesting, and storing than the red and yellow sorts. The flesh is fine in grain, pure white, and of superior flavour. The bulbs are large, and yield well when given careful attention. This sort should be grown in every family garden, in preference to any other large white American onion.

Yellow Strasburg (Yellow Dutch).—A productive variety, the bulbs being slightly darker in colour than yellow Danvers; of good size, quite flat, with a white and mild flesh. Yellow Danvers is preferred to the Strasburg by most growers.

Description of Foreign Varieties.

Barletta.—The bulbs of this variety are pure white, measuring from one inch to one and a-half inches in diameter, and about three-fourths of an inch in thickness. It is very early; said to mature a week or two earlier than the new queen. The bulbs are smooth, uniform. and handsome in appearance, which makes them especially valuable for pickling. For this purpose no other variety is better adapted. The flesh possesses a mild, delicate flavour. To secure the best results, the seed should be sown in loose, rich, friable soil.

Bermuda (Red mammoth Tripoli, Bermuda red).—The bulbs of this variety are large, fine-grained, and of excellent flavour. The skin is thin and rich, and of a blood-red colour. The flesh is white. It is largely imported into this country.

Early Pearl (Silver white Ætna, American pearl).—An Italian variety, which matures very early. The round, flattened bulbs are pure white, and possess a mild, pleasant flavour. It is excellent for sets or pickling, and is highly esteemed by some market gardeners.

Giant Rocca (Rocca of Naples).—This is a very large onion, that is well adapted to the transplanting method of culture in the South. It requires a long season to mature the bulbs. Its flavonr is mild and very pleasant. The bulbs are globular in shape, with a light, reddish-brown skin. It is very productive when transplanted, or where the season is of sufficient duration.

Giant Red Rocca.—This variety differs very slightly from the preceding, except that it is darker in colour.

Giant White Rocca (Silver ball).—One of the most valuable sorts of the Italian type. The bulbs are very large, white, globular, compact, and the flesh is white, with a mild, pleasant flavour. An excellent variety for either home consumption or market when the transplanting method is adopted.

Giant Yellow Rocca (Spanish king) resembles the giant red in every particular except colour, which is a bright yellow. This variety may be transplanted with very satisfactory results.

Mammoth Pompeii.—This is one of the largest of the foreign varieties, bulbs weighing over four pounds having been grown in this country. It does not appear to lose in quality when grown to such an enormous size. It should be grown by the transplanting method. The bulbs are red, with thin skins. The flavour, as is usual with the foreign sorts, is very mild and pleasant.

Marzajola (Italian may).—A small, early, flat onion. The bulbs are white, and of superior quality.

Giant White Garganus differs very slightly from the mammoth Pompeii, except that it is white. A valuable sort for the South.

New Queen (Pearl early white queen).—This variety is quite generally known in the South as the pearl onion, but "new queen" is the preferable name. It is one of the most valuable sorts for growing pickling onions from seed, although the Barletta is considered superior by many gardeners. The bulbs are pure white, and can scarcely be excelled in flavour. Seeds may be sown in February where the season is sufficiently early, and mature bulbs will be produced by June. If sown in July or August, another crop will be ready to harvest late in fall. The onions measure from one to two inches in diameter, and generally command high prices.

Prize-taker.—Burpee gives the history of this variety as follows:—"In the winter of 1887 a shipment of the fine, large, straw-coloured onions from Spain was received in San Francisco.

As the price was too high to command ready sale on the markets, a large proportion was bought in the early spring by a California seed-grower. Setting these large bulbs out for seed, the seed was first offered in 1888, under the name of prize-taker." This variety is a favourite with all growers who follow the transplanting method. It gives more general satisfaction than any other variety in the production of bulbs from seeds sown under glass, the young plants being transferred to the open ground. American-grown seed is greatly preferred. The prize-taker is uniform and globular in form, and very large, some specimens weighing from four to six pounds having been grown in this country under special cultivation, while from one to three pounds are very common weights. It ripens well, and if properly cured, may be kept through the winter, although it is considered a poor keeper. The bulbs are bright yellow, with a thin skin. The flesh is white, fine-grained, mild, with a delicate flavour.

Red Victoria.—A large, handsome, globular-shaped onion. Skin very dark red: flesh white or very light rose-coloured; mild, pleasant. A heavy, rich loam is best adapted to this variety.

Silver King (Mammoth silver king).—A very large, white Italian variety. Bulbs are flattened; flesh white, with a mild, sweet flavour.

White Italian Tripoli (El Paso, large Mexican).—The Texas Experiment Station reports that out of 58 varieties grown in 1895 from seeds sown in the open ground, this variety gave the largest yield. It is very large size, flat in form, with a white skin.

White Victoria.—The White Victoria is considered the most valuable of the white Italian onions for transplanting. The bulbs are very large, globular, and handsome. Wherever tested, it is most highly esteemed. It produces heavy crops when the proper treatment is given.

Growing Onions from Sets.

As regards methods of propagation, onions may be divided into two classes: (1) Those produced from sets, and (2) those produced from seed. In the first class belong the button, or top, onions, which are propagated by planting the little bulbs which form on the top of the stems in place of the seeds, and the potato onions already described, which are propagated from the sets produced by the division of the parent bulb.

The first method is employed by thousands of farmers and by many market gardeners, who make a business of growing bunching onions. These sets, either red, white, or yellow, are usually purchased from seedsmen at prices varying greatly in different seasons. The size of the sets also regulates the price to a considerable extent. They can usually be bought for three or four dollars per bushel, and it requires from six to ten bushels to set an acre. If it is desired to mature the bulbs, the sets should be planted at the earliest date possible. Some growers prefer fall planting where the climate is not too severe. If this plan is adopted the sets

should be planted early enough to allow them to become firmly rooted before the ground freezes.

Soil which is quite constant in the supply of moisture is best adapted to the production of mature bulbs from sets. Fertilisers should be used freely, and the soil thoroughly pulverised and rolled. The rows should be 12 or 13 inches apart, and the sets about three inches apart in the rows. The use of this method in growing mature bulbs in large quantities is not to be recommended. Better results can be obtained by sowing in the open ground or under glass, and transplanting the seedlings.

In propagating from seed two methods are practiced: (1) Sowing the seed in the open field without transplanting, and (2) Sowing the seed out of doors in the fall and transplanting to the permanent plantation the following spring, or sowing under glass in January, February, or March (depending upon the latitude) and transplanting to the field as early as the season will permit.

Growing Onions from Seed Sown in the Field.

The great bulk of onions produced in the United States is grown from seed sown in the open ground. If the soil is very fertile and especially well adapted to onion culture, very large yields may be secured by this method. An Ohio grower reports that he secured an average yield of over 800 bushels per acre in 1895, while some acres produced more than 1,000 bushels.

The American sorts, such as yellow Danvers, red Wettersfield, white Globe, and many other varieties, are almost exclusively grown by this method in the North. American onions, and all those of foreign origin, are produced from seed sown in the field in California and many of the Southern States. The summer season of California and of the south is of sufficient duration to allow the foreign varieties to mature, but it is important to select soils which rarely suffer from drought in these warmer localities or the bulbs will ripen before they have obtained the proper size.

Earliness in sowing is of the greatest importance, especially in the South, where the bulbs should attain the largest possible size before the advent of very hot weather. The soil should be harrowed and rendered fit for sowing the first day that it is dry enough to use implements.

The seed may be sown by hand or with a garden drill. If the soil is in the proper condition, about four pounds of seed should be used to the acre, which will require 12 to 14 seeds per foot.

Foreign-grown seed does not germinate so readily as American seed; hence a larger quantity should be used in order to secure a full stand. One-half to three-fourths of an inch is the proper depth to sow in most soils, although an inch is not too deep if the ground is sandy or very loose. Cultivating and weeding is more easily accomplished when deep sowing is practiced, but part of the soil must be drawn away from the bulbs when they begin to bottom, unless the ground is so light that it will not prevent the proper development of the onions.

The drills should be made from 12 to 14 inches apart. If a garden drill is used, which is always economy on large plantations, a trial should first be made on a clean floor to regulate the quantity of seed dropped. A marker attachment to the drill is valuable in marking straight rows. This is an important matter, for straight rows, with a uniform distance between them, greatly add to the attraction of the field, and facilitate the use of the wheel hoe. A line may be stretched as a guide by which to drill the first row. If the spaces become irregular as the operation proceeds, the rows should be straightened from time to time by means of the line.

Transplanting.

Transplanting consists simply in sowing the seed under glass early in the season (or in the open ground in the fall) and transferring the young plants to the field. Market gardeners have known for many years that the onion may be readily transplanted, and have taken advantage of this fact in filling vacancies. Exhibition specimens have long been grown by this method, both in England and America, and James J. H. Gregory reports having seen the plan followed in Northern Mexico in 1882, but the inference is that the seed was there sown in the open ground in the early spring and then transferred to the permanent plantation. The practice was brought to general public notice early in 1890, through an article written by T. Greiner, of Lasalle, N.Y., and published in "How the Garden Pays." W. J. Green, horticulturist, of the Ohio Agricultural Experiment Station, working independently, arrived at the same conclusions at about the same date. Both writers strongly advocated the system which they had thoroughly tested, and under the name of the new onion culture it has become generally known and extensively practised throughout the United States.

Experiments have demonstrated that the transplanting system has many advantages, the most important of which is, perhaps, the increase in yield. This increase is due to several causes. The plants receive a good start under glass before they are set in the field, and thus have the full advantage of the cool spring weather, which is most favourable to rapid growth; when sown in the field a month or more is consumed before the plants are fairly started. This is a very important consideration in the South, where the hot, dry weather may arrive very soon. Transplanting, if properly performed, always secures a full stand, which is uncertain where the seed is sown in the open ground. Pulling the plants results in more or less root pruning, and this doubtless exerts some beneficial influence on the yield.

Experiments at many agricultural experiment stations show how material is the increased yield. At the Ohio station 10 selected transplanted prize-taker bulbs weighed 8 pounds and 4 ounces; the same number of bulbs, not transplanted, 4 pounds and 4 ounces. Pompeii, transplanted, 7 pounds and 6 ounces; not transplanted, 4 pounds and 1 ounce. White Victoria, transplanted, 8 pounds and 6 ounces; not transplanted, 3 pounds and 7 ounces. Yellow Danvers, transplanted, 5 pounds; not transplanted, 2 pounds and

6 ounces. Transplanting gave a decided increase with each of the 14 varieties tried, amounting to 100 per cent. in some cases.

At the Michigan station transplanted prize-taker onions gave a yield of 548 bushels per acre, while bulbs not transplanted yielded only 216 bushels. Southport, transplanted, 296 bushels per acre; not transplanted, 172. Giant Rocca, transplanted, 556; not transplanted, 110. Experiments at the Rhode Island station gave a decided increase with yellow Danvers, red Wethersfield, and white Portugal. Red Wethersfield onions transplanted at the Tennessee station yielded 823 bushels per acre, while those not transplanted produced at the rate of 206 bushels. North Dakota station reports experiments with several varieties, including yellow Danvers, in which transplanted onions gave an increase from four to five times as great as those not transplanted. This enormous increase in North Dakota is due to the abundance of rain during the early spring.

Earliness in maturing is no less an advantage in many sections than the increased production. By transplanting, the large Spanish varieties, which are specially well adapted to this method, may be grown to perfection in the North, where the season is not long enough to raise large bulbs from seed sown in the open ground. It is not at all difficult in New York, for example, to mature prize-taker onions by August, at which time the bulbs usually command good prices. This point is equally important for Southern growers. In sections of the South where the conditions are favourable the bulbs can be easily matured by June, at which time small quantities bring remunerative prices, both on the home and on Northern markets.

When the transplanting method is followed, the bulbs are always uniform in size. This is a great advantage, resulting in better prices and entirely eliminating the small-sized picklers.

The seed should be sown at least six weeks previous to the date on which the soil will probably be dry enough to prepare for setting the plants. Either hotbeds or greenhouses may be employed in growing the plants. The latter is more convenient, but just as good plants may be raised in hotbeds. If a greenhouse is used, the ventilating apparatus should be so arranged that the plants can be hardened just as thoroughly as when grown in hotbeds. Cold frames will answer the purpose in many part of the South. The soil for growing the plants should be rich, loose, sandy loam, entirely free from stones, etc. If necessary, run it through a sieve. One and one-fourth ounces of seed are sufficient to sow under a three by six foot sash, placing the seed in drills one inch deep and three inches apart. To secure a full stand drop about 20 seeds to every inch of row, and when the plants are well started thin them out to 10 or 12 for each inch. If 10 rows are sown, 12 plants per inch will secure 9,500 plants under each sash. It will require 174,240 plants to set one acre, making the rows 12 inches apart and allowing three inches between the bulbs. It is necessary, therefore, to use 18 three by six foot sashes to raise enough plants for

an acre. The soil must be kept in a moist condition while growing the young plants, but an excess of water should be avoided, otherwise the plants make a spindling growth, or perhaps "slough" off. Ventilate freely on warm, bright days. Aim to secure strong, sturdy plants at the time of transplanting. Weak, spindling plants never produce satisfactory results.

The ground having been prepared according to directions already given, the rows are marked at the desired distances, 12 inches being sufficient space if a careful workman pushes the wheel hoe. Various devices may be used in laying off the rows. If a very small plantation is to be set, the garden line will be satisfactory. For marking large plantations there is no better device than the roller marker. It consists of a simple wooden roller three or four feet long and a foot in diameter. Pieces of one-fourth or one-half inch rope are nailed around the roller at the distance apart desired for the rows. Cross marks can be made at the same time by pieces of rope nailed lengthwise of the roller. These cross marks may be one foot apart. When the land is marked by this device the workman can set one plant at each cross mark and three between them, thus avoiding loss which may result from irregular planting where the rows are not checked.

For the most rapid and economical setting of the plants it is perhaps best to employ quick, active boys, separating them into squads of three. After rolling, have one boy make the holes with a dibble, let another drop a plant into each hole after the roots and tops have been trimmed back about one-third or one-half their length, while the third boy sets them at about the depth they stood in the seed bed. R. H. Price, of the Texas Experiment Station, reports that he uses the hand turning plough with good results in transplanting. The method is as follows:—Run a straight furrow with a small hand turning plough, lay the plants along the straight side of the furrow, turn the plough around and throw the dirt back to the roots, pressing it down with the feet or with a small roller. This method may doubtless be profitably used in some sections for special purposes, but hand setting is believed to be more accurate, and cheaper when very large, superior bulbs are desired.

In California some extensive growers sow the seed of the large Spanish varieties in the open ground in the fall and transplant the following spring. This plan would probably be well suited to the south, but it has not been sufficiently tested to determine its exact value.

The cost of growing the plants and setting them in the field are the objectionable features of this system. Nevertheless, many extensive growers follow the method and recommend it. A prominent onion producer of New York states that he can care for and transplant an acre of prize-taker onions as cheaply as he can sow and care for the same area of yellow Danvers. In this method one-third less seed is required and the expense of hand weeding is reduced to a minimum. The saving in these two particulars will nearly, if not quite, cover the cost of raising and setting out plants,

while the additional profits accruing render it much the better method for gardeners.

The main bulk of American onions, however, will probably always be grown from seed sown in the open ground. It would require a considerable investment of capital to procure the necessary frames and sash, or greenhouses, to grow enough plants for some of the extensive onion farms of the country, but for garden culture of most American varieties, and the general culture of the large foreign varieties, the transplanting system is of decided value.

Cultivating and Weeding.

Cultivation is practised for three purposes, namely: (1) To prevent the growth of weeds or to destroy those which have already appeared; (2) to form a loose surface mulch, which prevents rapid evaporation and also allows the free development of the bulb; (3) to admit plenty of air, thus promoting the chemical and other changes that prepare the plant foods for assimilation. The operation should begin as soon as possible. If the onions have been transplanted, use the wheel hoe at once to loosen the soil which has been packed by the workmen. When the seed has been drilled in, the hoe should be operated as soon as the location of the rows can be determined. The wheel roller attachment to many drills leaves a mark sufficiently plain in most soils to make the use of the wheel hoe safe before the onion plants have appeared. A few radish or turnip seeds are sometimes drilled in with the onion seeds; the plants from these make the rows very plain, and thus permit the early use of the cultivator.

The soil should be stirred frequently. Until the bulbs are well grown, cultivating can hardly be overdone. It is always desirable to stir the soil as soon as practicable after a rain to prevent the formation of a crust on the surface.

There are two classes of attachment to wheel hoes, namely, those cutting horizontally and those cutting vertically. The former are best for cultivating the plants when small, because they throw the soil away from rather than to the plants. When the bulbs begin to bottom, vertical cutting attachments may be used, being careful not to run deep enough to injure the roots. A wheel hoe, with double hoe which straddles the rows, may be used with excellent results as long as the plants are not large enough to be injured. For large plants the single hoe must be employed. The turn-plough attachment can be used to throw away the soil from the bulbs when they are bottoming.

Hand weeding is the most expensive item in growing onions from seed sown in the field. The work can be done best by careful boys. They should have their knees well padded with cloth, covered with leather. They straddle the rows (on their knees), weeding with some simple tool, with which the soil containing the small weeds may be thrown away from the rows. At the second weeding the plants should be thinned out to about one to the inch.

When the transplanting system is followed only two weedings are usually required, and these may be done with long-handled hoes or other tools, the operator in a standing position. Large weeds should be removed by hand if they appear late in the season, when the onion tops form a mat and will not allow the use of wheel hoes.

Irrigation.

The irrigation of onion plantations has been practised for many years in some of the western and south-western States, where the rainfall is not sufficient to supply the necessary amount of moisture. Several eastern growers have recognised the advantage of having a supply of water in droughty seasons, and have made provisions for irrigating whenever the crop requires it. Almost every section suffers more or less from drought, and if there are natural advantages for the securing of an additional supply of water it will pay to construct the necessary dams and ditches, and perhaps to erect windmills or use engines to pump the water. If the soil is very fertile and naturally well adapted to growing onions, and the markets or shipping facilities are favourable, there will be no risk in making a considerable expenditure preparatory to irrigating.

There are three methods of applying the water, namely, by flooding, furrow irrigation, and sub-irrigation. The first method is practised in Oregon, Colorado, California, Mexico, and other western States. The plan consists in planting the onions in beds which are banked on all sides to confine the water which floods them to the desired depth. A prominent grower of Oregon recommends the use of beds 10 to 20 feet wide and 10 rods long. He says:—"The beds, sidewise, should be perfectly level; and it is better to have them level lengthwise as well, though they may have a slight incline. If the beds are level lengthwise the ground can be wet to any desired depth. Water may be turned on until it stands one inch in depth all over the bed—which would be equivalent to a rainfall of perhaps 1½ or 2 inches—or it may be turned on to a depth of six inches, according to the requirements of the case. If the bed is an incline, the lower end should be left open, allowing the water to pass off, else that end will receive a great deal more water, and the ground will probably become packed."

In furrow irrigation the onions should be planted on ground which slopes just enough to allow the water to run in the small furrows which are made between the rows. These furrows may be made by the plough attachment of the hand wheel hoe. Small furrows may be run between all the rows, or larger ones at distances of from 4 to 10 feet, depending upon the porosity of the soil. If the latter plan is followed, which is perhaps the most satisfactory, it will be necessary to omit a row where each furrow is to be made.

Large ditches and flood dams are sometimes extensively used. In this case the main ditch, which conduct the water from a stream, is provided with a flood dam. Lateral ditches of smaller sizes are run at right angles, or nearly so to the main ditch, each provided with a gate where it joins the main channel. These lateral ditches

may be 20 to 40 feet apart. If the soil is loose and porous, 40 feet is not too much space to allow between them. By means of the flood gate at the stream from which the water is obtained, the current or a portion of it is turned into the main ditch. The flood gates of the lateral ditches are opened consecutively until they are filled and the entire plantation thoroughly soaked.

Sub-irrigation by means of two-inch tile has many advantages. The tiles are laid from 5 to 10 feet apart, and 10 to 12 inches under the surface. The water supply is derived from a higher level and conducted to the tiles by means of a hose or a combination of a hose and iron pipe. The water readily finds its way out of the joints of the tile, and permeates the soil in every direction. This system is especially applicable to small plantations.

Whatever system is adopted, care must be exercised that too much water is not applied; otherwise scallions are formed and the bulbs become spongy and succulent. Cultivation should follow each irrigation just as soon as the soil is dry enough.

Harvesting.

Onions should be promptly harvested at maturity. Harvesting should begin when most of the necks have turned yellow and are considerably withered. Although there is generally still quite a number of green tops when the main crop is ready for harvesting, the bulbs of these will thoroughly ripen if pulled along with the others. It is not safe to postpone the harvesting on account of a few green tops. If left too long in the ground the bulbs are liable to reroot, especially if there are frequent showers, and the quality of the bulbs is injured. Promptness in harvesting is not quite so important if the transplanting system is followed, as in this case the crop usually matures at a dry season.

The pulling of the crop is not an expensive operation if the bulbs are large and do not set too deep in the ground. Boys may be most economically employed in this work. The plants are simply pulled by the hand and deposited in windrows containing the onions from three or four rows. The crop is left in these windrows until fully cured, which will require from a week to ten or more days. On bright days the curing will be hastened by stirring with a wooden rake. The bulbs must be raked very gently to prevent bruising, which causes them to decay rapidly, special precautions being necessary in this respect with foreign varieties. If there is danger of a rainy season, the crop may be cured in open sheds or on a barn floor. The bulbs of white varieties must be handled with greater care than those of the red and yellow sorts. If the rays of the sun are very hot the onions should be gathered in piles, each containing enough onions to make about a barrel, and then protected by thin layers of straw. This will prevent the sun from turning exposed portions of the onions green. After the crop is cured the bulbs are sorted, topped if desired, and properly stored. All weeds and refuse should be removed from the plantation, and, if possible, a fall crop grown on the land. Celery is highly profit-

able to follow onions where the soil is favourable to the growth of this vegetable. Cowpeas or turnips may be sown, or a crop of pickling onions raised.

Winter Storing.

The winter storing of onions is always attended with more or less loss. If not thoroughly cured when stored many of the bulbs will sprout, and others will decay if they have sustained even slight bruises in harvesting. There will be more or less shrinkage, and a large percentage of the onions will be lost if the proper care is not given to ventilating and maintaining the desired temperature. For these and other reasons most growers prefer to dispose of the crop as soon as possible, and are willing to accept low prices rather than run the risk of loss by storage. This plan is doubtless the most judicious for those of limited experience or knowledge in the wintering of onions; but the prices received in the spring are generally so far in advance of fall prices that every grower should understand the conditions necessary to keep onions through the winter months. Very frequently the bulbs command one dollar or even two dollars more per barrel in the early spring than they do soon after harvest.

It is absolutely essential for successful winter storing that the bulbs should be well matured, thoroughly cured, not bruised, and in a perfectly dormant state. Most growers prefer topping the onions before storing. Sheep shears can be used to advantage in this work, leaving about an inch of the onion top extending above the bulb. The sorting may also be done by hand or by means of a screen, the rods or slats of which diverge, letting the bulbs fall into three hoppers, separating the onions into three grades.

Small quantities may be stored in pits, with satisfactory results. Select a well-drained location on which to place the onions in piles. Cover them with hay to the depth of about 12 inches, then add a layer of earth, and roof the mound with boards. It is essential that the bulbs be thoroughly protected from water, which causes decay. When the cold storage process is followed the onions are stored on floors or in bins, barrels, boxes, or crates. The temperature must never quite reach the freezing point, but should not rise more than two or three degrees above it. Free ventilation is essential on bright days when the cold is not too severe and the atmosphere is dry. Cellars will sometimes answer the purpose, but they usually contain too much moisture. Barns and well-constructed outbuildings are frequently frost proof, and will preserve the bulbs in perfect condition. Extensive growers, however, find it necessary to construct special buildings. An Ohio firm state that they annually cultivate about 400 acres in onions, and that a large part of the crop is cured in sheds if the weather is not dry enough to cure the bulbs in the field. The onions are then stored in the frost-proof buildings, with ventilators which may be opened at will, or closed to exclude the outside air when it is too hot or too cold. The temperature of the buildings is kept as low as possible without freezing the onions. Barrels, slatted boxes, and crates are used in storing.

The Production of Onion Seed.

It should be the aim of every grower of onion seed to produce only seed of the highest quality. The characteristics of the ideal bulb, already described, should be carefully considered by the producer of seed. The bulbs from which the seed is to be grown should be selected with care, rejecting those which do not approach as near as possible to the grower's ideal. Culls or unsaleable onions are too frequently used for this purpose, and although the seed therefrom in good seasons may be heavy and germinate readily they will not produce a satisfactory crop. By careful selection and judicious cultivation through a series of years, it is possible to greatly raise the standard of excellence. By this method the flat-formed bulbs, which are not so productive nor saleable, may be ultimately changed to those of a perfect globular form. For selection of soil, methods of preparing the ground, cultivating, fertilising, and storing the bulbs from which the seed is to be grown, the directions already given are applicable. After the soil has been properly prepared, cover the onions in trenches four or five inches deep, allowing about six inches between the bulbs. The rows, if to be worked by a hand wheel hoe, should be from 14 to 18 inches apart; if a horse is to be used in cultivating, about $2\frac{1}{2}$ feet apart. It is important to plant the onions as early as the spring weather will permit. Where the winters are not too severe, fall planting is preferable.

After the seed stalks are well started, the soil should be drawn about them to give the plants necessary support. This should be done three or four times during the season, finally leaving a ridge seven or eight inches high. Some growers prefer supporting the plants by means of twine stretched on either side of the rows.

After the last cultivation, the plants should be disturbed as little as possible until the time for harvesting. Promptness in harvesting is very important, for if delayed too long the seed receptacles crack open and part of the crop will be lost in handling. When the tops assume a yellowish appearance, remove them with five or six inches of the stem, and if over-ripe, deposit in tight vessels or in baskets with papers spread over the bottoms and sides to prevent loss. The entire crop does not mature at the same dates, hence it is necessary to examine the plants three or four times in order to remove the seed at the proper stage of ripening. The tops should be stored in a well-ventilated room with a tight floor until dry enough for thrashing. Frequent turning of the tops will hasten their drying and shake out more than half the seed. The remaining seed may be removed by flailing. Cleaning is done by repeated winnowing, and by washing in buckets or tubs to separate the light seed and chaff that the winnowing fails to remove. The seed must be thoroughly dried and stored in a location free from excessive moisture.

Bunching Onions, Sets, and Picklers.

Several methods are employed in the production of bunching onions. In the south, the potato onion is largely used, the bulbs

being planted in the fall. They are set in trenches 4 or 5 inches deep and placed 3 to 6 inches apart in the row. The bulbs increase and divide during the growing season, and may be pulled and bunched very early in the spring. Small sets of white or yellow varieties are extensively used by some market gardeners in the production of bunching onions. Either fall or spring planting may be practised. The sets should be planted $1\frac{1}{2}$ or 2 inches apart, allowing a foot between the rows. Seed is also largely used in raising bunch onions. The earliest crop can be secured by sowing in September or October, or sufficiently early for the seedling to become firmly established before the advent of cold weather. Fall sowing is best adapted to the warmer sections of the country. Seven or eight pounds per acre should be sown, making the drills 10 or 12 inches apart. The Barletta variety may be sown for early use.

The soil should be only moderately fertile for growing sets, but free from little stones and weed seeds. Seed is drilled in at the rate of from 50 to 60 pounds per acre. It is desirable to defer sowing in the spring until most of the weed seeds which may be present in the soil have germinated. The aim of the grower should be to secure a crop of very small bulbs as nearly uniform in size as possible. The price received is largely regulated by the size of the sets. Of course, a bushel of the smallest sets will plant a greater area than the same quantity of the larger ones, hence they command a higher price. When mature, the sets are lifted by a trowel and deposited with the surrounding soil in a sieve with meshes small enough to hold the smallest bulbs. A crib or dry, well-ventilated apartment may be used to cure the onions, spreading them in thin layers. It is extremely important to dry the sets thoroughly, so that they will remain in an entirely dormant condition until sold or planted. Before the final storing a fanning mill is used to remove the loose skins or light refuse. White sets command the highest price.

In the production of pickling onions about 25lbs. or 30lbs. of seed per acre should be sown. No variety is better adapted to this purpose than the Barletta. The bulbs when harvested should be as uniform in size as possible. Onions measuring from three-fourths of an inch to $1\frac{1}{2}$ inches in diameter are the proper size for this purpose.

Two Important Enemies of the Onion.

The onion maggot (*Phorbia ceparum*).—This is the most destructive insect enemy to this vegetable, both in Europe and America. The eggs are deposited on the plants near the ground, requiring about a week to hatch. After the eggs hatch, the larvæ therefrom burrow in the bulbs, where they remain for about two weeks, then emerge, pupate in the ground, and the adult insects deposit their egg for another generation. The larvæ cause the plants to turn yellow in colour, wither, and finally die before the bulbs have matured.

Various preventative measures and remedies have been suggested, as the application of unleached wood ashes and charcoal spread over the beds, the use of gas lime between the rows, the sowing of potash salts, rolling the beds before sowing, growing the bulbs in trenches, drawing the earth about them as they grow, and several other measures have been recommended. Planting in a new location each year is, perhaps, the most effective preventative.*

Onion smut (*Urocystis cepulæ*).—This disease attacks the young plants, causing the formation of dark spots or lines on the leaves. As the onion seedling develops, these spots crack open, exposing a black, powdery mass, which contains the spores of the fungus. The disease, if very severe, causes the tops to wither and die, and then often spreads to the bulbs. Onion smut is more or less prevalent in different parts of the country, the loss therefrom being very serious some years. As a preventive all the refuse upon the onion field should be burned immediately after the crop has been harvested, thus destroying most of the spores, from which the disease rapidly spreads the following season. Adherence to a strict system of crop rotation is the most practical preventive against the disease. Transplanting is also quite effective.

Experiments at the Connecticut Agricultural Experiment Station have demonstrated that treatment with a mixture of equal parts of sulphur and lime, or of sulphide of potassium and lime, increased the yield on land badly infected with smut in a ratio of about five to one. The mixture is sown in drills with the seed.

Summary.

The onion requires a light, friable, well-drained, fertile soil, well stocked with organic matter. Onions are extensively and successfully grown on reclaimed marsh soils.

Soils which are deficient in organic matter, and which have been reduced by exhaustive cropping, should be renovated by cultivation in other crops on which barnyard manure, green manures, and other fertilisers are liberally used. The onion requires liberal fertilising, and since the cost of labour is about as great for a crop of 500 bushels as it is for 1,000 bushels, it is good economy for the onion grower to be liberal in the use of fertilisers. Soils which have been freely cropped with cowpeas or other leguminous plants are not likely to be deficient in nitrogen, although light dressings of the quick-acting nitrate of soda may often prove profitable, while potash and phosphoric acid must be applied more liberally. When nitrogen is needed, applications of 200 to 400 pounds per acre of nitrate of soda in four equal dressings is recommended. Potash may be supplied in the form of wood ashes at rates of from 6 to

* Carbolic acid emulsion has been found to be an effective remedy by the New York Cornell Experiment Station. The emulsion is made by dissolving 1lb. of hard soap, or 1 quart of soft soap, in a gallon of boiling water, to which one pint of crude carbolic acid is added; the whole being stirred into an emulsion. One pint of this is added to 30 quarts of water and poured around the bases of the plants, about 4ozs. per plant at each application, beginning when the plants are set out, and repeated every week or ten days until the last of May. To bring about the best results, some of the earth should be removed from about the plants before pouring on the emulsion.

8 tons of unleached ashes, or 10 to 14 tons of leached ashes per acre. Potash may also be supplied in kainit, 800 to 1,000 pounds per acre, and muriate of potash, 200 to 300 pounds per acre. A few hundred pounds of bone meal or other phosphates may be used if phosphoric acid is required.

Late fall ploughing is generally advisable, care being taken to completely cover all manure applied and to thoroughly pulverise the soil, but not to bring any of the subsoil to the surface.

Seed should be selected with great care and a preliminary test of its germinating power made.

Varieties successfully grown are divided into two classes: (1) American varieties, the most prominent of which are Danvers, extra early red, Egyptian, red globe, yellow globe, potato onion, shallots, silver skin, Wethersfield, white globe, and yellow Strasberg; (2) foreign varieties, of which the following are the more important kinds grown in this country: Barletta, Bermuda, early pearl, giant rocca, giant red rocca, giant white rocca, giant yellow rocca, mammoth Pompeii, marzajola, giant white garganus, new queen, prize-taker, red Victoria, silver king, white Italian Tripoli, and white Victoria. The American varieties keep longer and are better adapted to most parts of the United States, but foreign varieties possess certain desirable qualities which give them a high market value.

Onions are propagated from (1) sets, (2) from seed sown in the open ground without transplanting, and from seed sown out of doors in the fall and transplanted in the following spring, or from seed sown under glass in January, February, or March, the young plants being set out as early as the season will permit. The first method is extensively employed by market gardeners who make a business of growing bunching onions. It is not recommended for growing mature bulbs in large quantities. For this purpose, sowing the seed in the open ground or under glass and transplanting the seedlings is recommended. When set at a distance of 3 inches in rows 12 inches apart an acre requires 174,240 plants.

Cultivation should commence early, and should be frequent to keep the soil well stirred and to prevent the growth of weeds. Hand weeding is necessary in the early stages of growth, but certain forms of the wheel hoe may be used with advantage for the larger part of the necessary cultivation.

Where a water supply is reasonably accessible, provision should be made for irrigation whenever the crop requires it.

As soon as the bulbs attain full size and the tops turn brown they should be pulled, thrown into windrows, and allowed to cure for ten or more days, or if there is danger from rain the curing should be done in open sheds or on the barn floor. Excess of either sunshine or rain is likely to injure the bulbs. The most common processes of wintering the onions are: (1) Freezing the bulbs and keeping them in this state all the winter, and (2) storing

them in dry apartments where the temperature can be maintained just above the freezing point.

In growing onions for seed a strict system of selection with a view to the development of an ideal type should be followed. In general, the same methods followed in ordinary culture are applicable in this case. For bunching onions, bulbs of the potato onion or some of the white or yellow varieties, planted generally in the fall in trenches 4 or 5 inches deep, at distances of 3 to 6 feet, are used. The bulbs are pulled and bunched early in the spring. Sowing the seed in September or October is also largely practised in raising bunched onions. For sets, the seed is drilled in the spring in moderately fertile soil, free from stones and weed seeds, at the rate of 50 to 60 pounds per acre, the object being to secure a crop of very small bulbs of uniform size. These bulbs should be thoroughly dried to render them dormant before storing. The Barletta variety, seeded at rates of from 25 to 30 pounds of seed per acre, is recommended for the production of pickling onions, which should be from three-fourths to $1\frac{1}{2}$ inches in diameter.

The principal enemies of the onion are the onion maggot *(Phorbia ceparum)* and onion smut *(Urocystis cepulæ)*. For the first the most effective remedy is a change of location of the onion field each year. Carbolic-acid emulsion applied around the roots has also given good results. The latter is held in check to some extent by rotation of crops and by transplanting. A mixture of equal parts of sulphur and lime or sulphide of potassium and lime sown in the drills with the seed has given good results as a remedy for the disease.—*Farmers' Bulletin, U.S.A.*

RABBIT DESTRUCTION.

The following poisons are generally used for the destruction of rabbits throughout the State of Victoria :—Phosphorised oats and wheat; arcenised oats and wheat; phosphorised pollard; chaff and arsenic; apples and quinces with strychnine; apples, carrots, and arsenic; jam and strychnine.

The recipes for mixing are as follows :—

Phosphorised Pollard.

Obtain a quart preserving jar or similar vessel, half fill with water, in which place one stick (2oz.) of phosphorus. Then pour in sufficient carbon to cover the phosphorus. The carbon having a much greater gravity than water will go to the bottom of the vessel, and not mix with the water. Being under the water there is no risk whatever either from it or the phosphorus. In about eight or ten minutes the phosphorus is dissolved. Then

pour contents of vessel into six quarts of cold water, add 12lbs. of sugar, when dissolved add pollard gradually till it comes to the consistency of thick dough, when it is fit for use. The stirring must be continued from the time the contents of the vessel are put into the six quarts of water until the operation is completed. The mixing vessel must be kept scrupulously clean, and care taken that there are no holes in it. The above will result in about 50lbs. of bait. It is necessary that the phosphorus should be entirely covered with the carbon, therefore the smaller the vessel the less carbon is required. One tablespoonful of carbon will dissolve a stick of phosphorus. The bait should be made the night previous to laying when carbon has been used, so that no trace or smell of this latter will remain.

Phosphorised Oats or Wheat.

Quantities: 60lbs. best grain, 4 gallons water, about 9ozs. phosphorus. Dissolve the phosphorus in carbon and water, as shown in phosphorised pollard recipe. Make a half-gallon of thick paste with flour and boiling water, free from lumps. Place the grain in a revolving machine made for this purpose. When the paste is cold, pour the dissolved phosphorus, etc., into it, and stir well until the ingredients are thoroughly mixed. Make a hollow space in the grain to receive the paste, and pour it into it. Move the machine to and fro until the grain has caught up all the paste (say, three or four minutes), then turn the machine gently. When the smoke which is created is sufficiently dense as to hide the grain from sight, turn it out on to clean bagging, spread out in a shady place on, say, some sheets of iron; keep stirring the wheat until all signs of smoke has disappeared, when it will be shortly ready for use. The above strength of phosphorus gives the best killing results. Using a greater strength may defeat the object in view by setting up oxidation of the grain. Many failures are due to this. Although grain may be prepared in open vessels, the use of the revolving machine is infinitely surer and safer.

In cases where carbon is not used, the following method can be adopted, but it is not considered in any way as good as the above:—

Place the grain in a revolving machine. Light a fire close at hand, upon which place two buckets with two gallons of water in each. When the water boils, put $\frac{1}{2}$lb. (four sticks) of phosphorus into one of the buckets, and stir slowly for three or four minutes until phosphorus is dissolved. Pour this mixture into machine, and add water from the other bucket as quickly as possible. Close the lid and turn machine slowly for about 20 minutes. If the machine has not then cooled sufficiently to allow the hand to be placed upon it without burning, pour a bucket of water over it and turn for a few minutes. The machine should be turned for five minutes four hours after mixing, and also again for the same time eight or nine hours afterwards. In 24 hours the mixture should be taken out and spread at once. Give machine a few turns before taking oats out.

Chaff and Arsenic.

Thirty pounds best green chaff, 2lbs. arsenic, 3lbs. sugar, 1 gallon water. Obtain a large zinc-lined case and spread about 10 or 12lbs. chaff evenly at the bottom. Boil the water and mix sugar in it. Then sprinkle the water over the chaff and shake in the arsenic in pepper-box fashion and mix thoroughly. It is only necessary to damp the chaff sufficiently to make the arsenic adhere to it. This mixture should be spread at once, as rabbits will not eat poisoned food which has changed its natural appearance from fermentation or any other cause.

The use of above is not strongly recommended. It will only be found to succeed where there is a great scarcity of feed, and it is always most dangerous to stock.

Grain and Arsenic.

Fifty pounds grain, 1lb. arsenic, 4lbs. sugar, $1\frac{1}{2}$ gallons water. Put the arsenic and water into suitable boiler, adding $\frac{3}{4}$lbs. of washing soda. Boil till thoroughly dissolved, when the water should become tea-coloured and no white sediment should be visible on the stirring stick. Add the sugar and then pour the contents over the wheat or oats. Leave the mixture in a tub or vessel for about 12 hours, when all the liquid should be absorbed. The grain can then be spread on bags or iron to dry when it is fit for use or for putting in tins for future use. In some instances the grain will absorb more water than is mentioned above, but this can be regulated.

This mixture will be most useful to persons who are, perhaps, afraid of using phosphorus on account of possible risk of fire in using the latter. However, there is only danger in the latter case when badly mixed. If the phosphorus is dissolved in carbon there is no risk even with imperfect mixing. The killing properties of the arsenised grain is equal to strychnine. The use of the washing soda is strongly recommended, as it increases the absorbtion.

Apples or Quinces and Strychnine, and Carrots and Strychnine.

Cut into small pieces (an ordinary apple should make 50 or 60 baits). Dust with 1oz. of strychnine to 10 or 12lbs. of fruit, say, with a large-sized pepper castor. It is a good plan to mix some pollard or flour with the strychnine, so that it will not dust too thickly or freely. Lay in the plough furrow from 6in. to 3ft. apart, according to the infested state of the place. The advisability of "free feeding" several times beforehand where above poison is to be used cannot be too strongly recommended, in fact it is almost essential to success. If the free baits are well taken, success is absolutely certain. The rabbit comes to the furrow eager and unsuspicious, and falls an easy victim. On the other hand, if the free baits are not taken, there is obviously no use in laying the poisoned bait, and some other poison should be tried. In cases where the furrows cannot be readily made, good work can be done by laying

the poison on scratches similar to those made when trapping. This also applies to other baits, grain or pollard. When poison is taken, the furrows should be replenished until the rabbits cease to take it. It is hard to err on the side of liberality, but very easy to do the opposite. It is far better to have some poison wasting in the furrows than to have a few rabbits left for future breeding.

Carrots, Apples, Etc., and Arsenic.

Twenty pounds apples or carrots and 1lb. arsenic; sift the arsenic on dry with a dredger. When using carrots it is advisable to lightly damp them in a thick solution of sugar. With apples this is not necessary, as there is sufficient acid in the apple to absorb the poison.

Jam and Strychnine.

Eight pounds of jam (any kind) and $\frac{1}{2}$oz. of powdered strychnine; mix well and lay on a small piece of bark or wood in a ploughed furrow.

In this connection the use of the prepared jams on sale by manufacturing firms is recommended, in view of the fact that a small quantity goes a long way, and the cheapness and certainty of the manufactured article. In country where ants are plentiful it is expedient to put the jam down as late in the evening as possible, as this insect readily finds it, and is objectionable to the rabbit.

METHOD OF LAYING POISONS.

For any poisoning, undoubtedly the furrow or scratch is far and away the best. Nothing can equal it for certainty. The attraction to the rabbit is irresistible. It will always come to it to play and scratch on, and therefore must find the bait sooner or later. But when the country does not allow of the use of the plough or the sledge the soil should be upturned by other means. I have noticed cases where the top of the ground has been smoothly taken off, and the poison laid thereon. This is not advisable—the ground should be broken, not smoothed over. As a rule, the poison is not so freely taken if laid too near the burrows. It is much more certain if put on their feeding and playing ground.

It is generally accepted that the best time for poisioning is in the summer months, when the grass is dry. Without in any way impugning this belief (which is quite justified by results), I may mention that in the western district the custom was only to lay poison at the break up of the summer—at the first autumn rains. I had charge of a large district in which for ten years (from 1880-90) poison was only laid from autumn to the spring, and as soon as summer set in was discontinued, and the work was extraordinarily successful. The most successful results I ever saw were obtained in good green grass, the presumption being that the

rabbits took the grain by way of change from the green feed, and I feel assured that if judicious poisoning were done during the winter months, or at any rate when the grass is green, good results would ensue.

It is often advisable to "ring the changes" as regards poisons. What is successful one time may not be so another. The rabbit is somewhat fickle in his tastes according to a variety of causes, such as weather, seasons, and the state of his natural feed, and it is a good thing to find out what it may take best at that particular place or time, and indulge it accordingly. I have had most successful results by pursuing this course.

Great care should in all cases be exercised as to cleanliness in preparing poisons and laying same. The rabbit is cleanly, and keen to detect anything suspicious in the food spread for it.

Poisoning operations, however successful, should always be followed up by other means. There is always a percentage of vermin left quite sufficient to breed up again. These should be got at by digging out, fumigation, or by setting traps in the mouths of the burrows (so that the breeding does and young rabbits be also caught), and not on the runs or "buck-heaps," etc., where the marketable rabbit stands the best chance of being trapped, and the doe mostly escapes to keep up the future supply. No trapping will lead to anything like a satisfactory result unless the burrows are thoroughly worked. But it is undoubtedly best to always destroy the burrows. No work is complete without this. If these are left the house is always awaiting tenants, and be sure they will find occupants sooner or later. This action, coupled with the destruction of harbour, such as fallen timber, log fences, hedges, etc., is the crux of rabbit destruction, and, if properly followed, must lead to success.

DALGETY'S REPORT.

Messrs. Dalgety & Company, Limited. wool and produce brokers, Perth, Fremantle, and Kalgoorlie, report as follows for the month ended 6th May, 1904:—

Wheat.—Wheat continues to be slow of sale, the Continental and inter-State markets being irregular, with a weaker tendency. With regard to W.A. markets, farmers still hold considerable quantities, being disinclined to sell at present rates. There is not very strong inquiry from millers just now, and wheat is being offered at 3s. 1d. per bushel, f.o.r., York, Northam, and Beverley.

Perth and Fremantle markets have been somewhat indifferently supplied, and values have ruled at 3s. 3d. to 3s. 4½d. and 3s. 5d. per bushel, and at this latter price the market is firm.

Algerian Oats.—Consignments have come forward to auction very slowly during the month, although we have to report considerable business, having sold large quantities privately in the country.

Prices remained unchanged, and closed as follows :—

Local oats (good feed), 2s. 2d. to 2s. 3d. and 2s. 4d. per bushel.
Local oats (seed), 2s. 5d. to 2s. 10d. per bushel.

The local production of Algerians is far from being equal to the requirements of this State, and the growing of Algerian oats is capable of great development, as, weekly, we are importing large quantities of Algerians, as well as Tasmanians and New Zealand white oats. Algerian oats are meeting with better demand than formerly; many buyers, who until recently would have nothing but white oats, are ordering Algerians for the reasons that there is a great difference in price in favour of Algerians, and, moreover, the quality of local Algerians has been very satisfactory.

Barley.—There seems to be very little W.A. barley in farmers' hands at the present time. During the past few weeks we have had good demand for Cape and skinless barley, but were forced to procure these lines from the Eastern States. English barley is in fair request, and we have to report sales during the month of about 2,200 bags for malting and seed purposes. Nominal value English barley 3s. 9d. to 3s. 10d. per bushel. Skinless barley for seed 4s. per bushel.

Chaff.—The chaff markets are in a somewhat excited condition. Early in the month prime green wheaten chaff was selling at £3 15s. per ton to £3 17s. 6d. per ton; all other grades were quoting accordingly. Supplies have come forward to both Perth and Fremantle, and Kalgoorlie, very slowly; in fact, the offerings have fallen far short of consumption requirements, which, of course, sharpened the demand, and, towards the end of last week, prices at Perth and Fremantle showed a material advance :—

Prime green wheaten now selling		at £4 15s. per ton.
Good quality wheaten	„	at £4 to £4 7s. 6d. per ton.
Wheaten lacking colour	„	at £3 10s. to £3 15s. and £3 17s. 6d. per ton.
Prime oaten with colour		at £4 15s. per ton.
Good quality oaten		at £3 10s. to £4 per ton.
Dry oaten		at £3 to £3 5d. per ton.

Damaged and inferior lines from £1 17s. 6d. per ton upwards.

For these latter lines there is no regular market value, they being quite unsuitable for town trade. At the above rates, the market is very firm, and there are indications that values may further harden.

Throughout the month the auction sales were well attended, and all lots submitted met with good competition at prevailing rates.

Some weeks ago consignments of chaff to Perth and Fremantle markets were arriving at a rate greatly in excess of consumption requirements. This was causing prices to be unduly depressed, and rather than let so much chaff be sold at such unsatisfactory figures, we endeavoured to cope with the situation by sending into store a large quantity of chaff on account of farmers; and it is gratifying to know that the recent advance in the market has fully justified our action in this matter. Supplies are being drawn from all districts, the best qualities coming from Green Hills, Mount Hardy, Mount Kokeby, and Pingelly.

Hay.—Pressed hay is in slightly better demand, and prices have moved up in sympathy with higher chaff values. We have sold good wheaten hay at £3 17s. 6d. per ton at Fremantle; prime oaten hay at from £4 to £4 10s. per ton. However, we could not recommend consignments of pressed hay, as this is a line which is expensive to handle, and, as also the demand is unlike chaff, spasmodic, we prefer to do this business privately.

Pressed Straw.—Consignments of pressed straw are coming forward rather too freely this week, and it is also a line which at present we could not recommend consignments. Nominal values, 30s. f.o.r., Northam.

Kalgoorlie.

We have to report that latterly supplies of chaff have been very light; indeed, at the present time, arrivals fall far short of local requirements, and we could readily sell prime green wheaten chaff at to-day's market rates. Buyers are continuously inquiring for good quality samples, and we are having difficulty to meet our orders. The demand for prime green wheaten is especially keen, and, from the present outlook, a further improvement in prices may be looked for. On the other hand, damaged and inferior lines are in poor demand, and we would strongly advise our clients that Kalgoorlie offers no sale but for the best samples, our buyers being unable to find a use for musty and wet chaff.

Closing rates for the month are:—

Prime green wheaten in firm demand, at from £5 5s. to £5 10s.
Good quality wheaten, £5 2s. 6d. per ton (good demand).
Medium samples in fair demand at £4 15s. to £4 17s. 6d. per ton.

All consignments of chaff that are coming along just now are realising good prices, and we could strongly advise consignments to Kalgoorlie.

Wheat.—Wheat is also in better demand, and we have to report sales at 3s. 11d. per bushel.

Fremantle, 6th May, 1904.

Hides, Skins, Tallow, etc.

Messrs. Dalgety & Co., Ltd., report having held their usual weekly salė on Friday, 6th May:—

Sheepskins.—We submitted a representative catalogue in which was included several good lines from stations in the North-Western District. All classés were in strong demand, a ready clearance being made of all offerings, any change in values being in favour of sellers. Quotations:—

Good Merino, ¾ to full wool	...	6¼d. to 6⅝d.	per lb.
Medium " "	...	5½d. to 6d.	"
Good " ½ to full wool	...	5½d. to 6d.	"
Medium " "	...	4¾d. to 5¼d.	"
" " ¼ to full wool	...	4½d. to 5d.	"
Fine Cross-bred, ¾ wool ...	...	5¾d. to 6¼d.	"
" " ½ " ...	...	5¼d. to 5¾d.	"
Medium " ½ " ...	...	5d. to 5½d.	"
Coarse " ½ to ¾ wool	...	4½d to 5d.	"
Pelts	...	4d. to 4½d.	"

In all cases where pelts of above are sundried, weevil-eaten, torn, or perished prices are from 1d. to 2d. below quotations.

Hides.—A larger offering than usual; competition being dull and dragging. and a fall of ⅛d. to ¼d. per lb. must be reported, medium and heavy weights being specially affected. Quotations:—

Heavies ...	5d. to 5¼d.	per lb.	Dry ...	4⅞d. to 5⅛d.	per lb.
Medium ...	4½d. to 4¾d.	"	Damaged ...	3d. to 4d.	"
Light ...	4¼d. to 4½d.	"			

Attention to flaying, and preparation for market is very necessary, and results in enhanced values.

Kangaroo Skins.—A fair selection of red skins sold readily. Quotations:—

¾lb. to 1lb. average	...	1s. 10d. to 2s. 1d.	per lb.
½lb. average ...	...	1s. 3d. to 1s. 6d.	"
1½lb. " ...	...	1s. 6d. to 1s. 10d.	"
Damaged lines ...	...	9d. to 1s. 6d.	"

Blue Skins rule 3d. per lb. above these values.
Euro Skins from 1s. 2d. to 1s. 9d. per lb.

Tallow.—Nominal price (in casks), 21s. 6d. per cwt. Medium, mixed (tins and oddments), 18s. to 20s. per cwt.

GARDEN NOTES FOR JUNE.

By Percy G. Wicken.

The early fall of rain during the last week in March, followed by a month of almost cloudless warm weather, should do much to help the growth of vegetables. The beginning of the present month has brought in the regular winter rains, which we may now expect to continue. If the ground has been properly prepared, a large number of seedlings of all kinds of vegetables can be planted out immediately, and if good healthy plants are put out and well supplied with manure, they will make rapid growth. A few frosts will have probably occurred by this time, we have already had one in this district (Narrogin), this will no doubt kill the few remaining beans left of the summer crops, but will not hurt the winter crops of cabbages, cauliflowers, and root crops. Cabbages and cauliflowers are very gross feeders, and to obtain good results require to be either planted on naturally rich soil, or to be kept growing by being well supplied with manures, these are best applied in a liquid form, and are then readily available for the plant to take up. Cabbages and cauliflowers thrive best on a nitrogenous manure, whereas, turnips require superphosphate; peas, superphosphate and potash. For a small garden, the manure is best applied in small quantities and at frequent intervals. If the ground is likely to become wet, drains should be dug to carry off all the stagnant surface water.

Artichokes (Globe).—May be planted out at any time during the next few months. Either suckers from old plants or rooted plants may be used. If the soil is good, plant 3 feet apart each way, as they grow to a good size; if poor soil they may be planted closer.

Asparagus.—If not already done, prepare a trench, as previously described, for spring planting.

Beans (Broad).—Should now be growing well, and in some districts will be in bearing. A few more rows should be planted to keep up a succession.

Cabbage.—Plant out all the strong healthy plants that you have, taking care that the roots are placed in the ground to the same depth as they were in the seed bed. Plant out a further supply of seed for future use.

Cauliflowers.—Plant same as cabbages, but they require to be sown as early as possible.

Carrots.—Thin out those already up; sow a few rows for future use.

Celery.—Plant out in trenches all plants that are ready, and those already growing should be well earthed up so as to bleach them and make the stalks tender.

Leeks.—Plant out any seedlings from the seed beds, and sow a further supply of seed. As soon as the plants reach six to eight inches in height they should be planted out in shallow trenches, first trimming off their roots, and cutting back the leaves.

Lettuce.—Plant out what seedlings you have. Sow a further supply of seed for future use.

Onions.—Plant out all young plants available, and sow a further supply of seed. In planting out in the beds do not plant too far apart; rows 12 to 15 inches apart, and from four to six inches in the rows, will be sufficient.

Peas.—Pull up all old plants that have ceased bearing and plant out a fresh supply. There is always a good demand for this vegetable. All tall growing varieties should be staked.

Turnips.—Those already up should be thinned out and kept free from weeds. A few more rows may be sown to keep up a supply.

Farm.—The present is one of the busy seasons of the year on a farm, although on a well-conducted farm in which everything does not depend on one crop, the busy season lasts all the year round. Seeding operations will be in full progress during this month, and in fact settlers who have fallow land to crop will have almost completed their sowing by this time; those not so fortunate will have to plough and sow as fast as they are able to do so, and can only get their crop in as fast as their means allow them. The fine weather experienced during April has been a great help in enabling settlers to get as much work done as possible before the rain sets in. Within a reasonable limit the earlier sown crops give the best results, and also effect a great saving of seed; starting, say, April 14, with about 40lbs. seed wheat to the acre, the quantity would have, at a rough estimate, to be increased about 5lbs. of seed for each week later in the season that it was sown, as the later sown crops never stool out to such an extent as those sown earlier in the season. Pickling wheat to prevent smut is, I am afraid, much neglected, but all experiments carried out on this subject demonstrate that it pays to do so. The wheat can either be dipped in the bluestone solution as previously described, or as is often done, the wheat spread out on the floor and thoroughly watered with the solution, the seed being continually turned over with a spade in the meantime. This method is somewhat less trouble, but is not so effective as the dipping the seed in a cask of solution. Another advantage of dipping the seed in the solution, a basket at a time, is that all the light weed seeds float to the surface and can be skimmed off, thereby saving the spread of weeds. Harrowing and rolling the crop after the seed drill has sown the seed should be always carried out, although the rolling will not hurt if done when the crop is six inches high, provided the ground is not too wet.

HORTICULTURAL, AGRICULTURAL, AND STOCK LECTURES.

A series of lectures on Horticultural, Agricultural, and Stock matters will be commenced on Friday evening, June 3rd, at 8 o'clock p.m., in the Museum attached to the Department of Agriculture, St. George's Terrace, and continued weekly. They will be illustrated with lantern views, and will comprise the following subjects:—

June 3	Fruit Trees: How to plant and how to prune them ...	Mr. Despeissis.
„ 10	Fruit: The kinds to grow and how to market	do.
„ 17	The growth of cereals	Mr. Faulkner.
„ 24	Manures, and their uses ...	do.
July 1	Horses: Their breeds and management	Mr. Weir.
„ 8	Cattle: Their breeds and management	do.
„ 15	Pigs: Their breeds and management	Mr. A. Crawford.
„ 22	Sheep: Their breeds and management	Mr. Faulkner.
„ 29	Goats: Their breeds and management	do.
Aug. 5	Poultry: Their breeds and management	Mr. Robertson.
„ 12	Insect Pests, and their treatment	Mr. T. Hooper.
„ 19	Bees, and their management ...	Mr. J. Sutton.
„ 26	Diseases of Stock	Mr. Weir.
Sept. 2	Potatoes and Vegetables ...	Mr. Baker.

ADMISSION FREE.

THE CLIMATE OF WESTERN AUSTRALIA DURING APRIL, 1904.

The only noticeable feature of the weather during April was the heavy rain which fell in the South-West at the end of the month. On the morning of the 27th Easterly winds prevailed throughout the State, and barometers commenced to fall. Next morning Cape Leeuwin barometer read 29·94, a fall of $\frac{2}{10}$ of an inch in the 24 hours. During the day the wind veered to the North-West, and in the evening showery weather set in there. This gradually extended up the West coast, and on the evening of the 29th heavy thunderstorms and rain were experienced throughout the South-West, the rain extending as far North as Sharks Bay, and inland over the agricultural districts, but the storm appears to have spent its energy before reaching the fields, as only light scattered showers were recorded on the Southern portions of the Coolgardie Goldfields on the mornings of the 1st and 2nd.

2·62 inches fell between 11 p.m. on the 29th and 9 a.m. on the 30th at the Observatory. This is the heaviest fall in 10 hours that has been recorded there, but on two occasions the total for the 24 hours has been exceeded. At Rottnest and Fremantle the rain was comparatively light, only 43 and 64 points respectively being registered.

For the whole month the rainfall was again exceptionally heavy throughout the Kimberley district, especially in the West. In the North-West and Murchison very little fell, and over the Coolgardie Goldfields and along the South coast. East of Albany it was below the average, but in the South-West between Perth and Albany considerably above.

The atmospheric pressure was below normal throughout the tropics, and the day temperatures about 5° less than the average for previous years, but over the rest of the State both the pressure and temperature were about normal, except over the goldfields, where the temperature was about 3° above.

The following table, giving the mean minimum night temperatures on the surface of the ground and the lowest recorded during the month, will show that the cold weather has already set in:—

Station.	Mean.	Lowest.	Date.
Peak Hill	55·0	44·0	18
Cue	56·0	45·0	18
Coolgardie	49·1	36·8	28
Southern Cross	48·9	32·0	18
Walebing	46·2	31·0	20
York	48·2	34·5	18
Perth Observatory	51·8	35·5	19
Wandering	41·3	28·0	22
Katanning	40·4	26·0	18
Bridgetown	41·8	29·0	18, 21
Karridale	44·0	30·0	18

The Climate of Western Australia during April, 1904.

	Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Barometer: Average for previous years.	Barometer: Highest for Month.	Barometer: Lowest for Month.	Shade Temperatures. April, 1904. Mean Max.	April, 1904. Mean Min.	April, 1904. Mean of Month.	April, 1904. Highest Max.	April, 1904. Lowest Min.	*Average for previous Six Years. Mean Max.	*Average: Mean Min.	*Average: Highest ever recorded.	*Average: Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Rainfall. Total Points since Jan. 1.
North-West and North Coast:	Wyndham ...	29·856	29·907	30·014	29·617	89·7	74·0	81·8	97·0	67·0	95·5	77·3	103·2	63·5	315	2874
	Derby	29·852	29·917	30·210	29·560	90·0	69·6	79·8	97·6	54·5	95·7	70·9	103·2	55·0	517	3123
	Broome ...	29·886	29·924	30·030	29·510	88·5	71·2	79·8	98·2	58·0	93·8	71·6	102·4	56·0	610	1999
	Condon ...	29·888	29·945	30·074	29·650	90·7	67·3	79·0	101·1	50·7	90·1	66·3	103·0	46·0	*Nil*	213
	Cossack ...	29·845	29·954	30·083	29·693	93·1	70·6	81·8	104·0	57·8	91·2	70·2	105·0	59·7	*Nil*	240
	Onslow ...	29·925	29·950	30·120	29·757	92·1	69·9	81·0	105·0	56·2	92·0	67·5	105·0	53·0	*Nil*	171
	Carnarvon ...	29·969	29·992	30·102	29·810	85·8	65·1	75·4	94·7	54·7	82·9	64·0	108·0	46·0	15	160
	Hamelin Pool...	29·970	30·004	30·130	29·790	89·0	62·0	75·5	99·0	48·0	85·6	61·6	105·6	50·0	19	55
	Geraldton ...	30·030	29·976	30·220	29·780	80·5	58·3	69·4	91·5	50·0	83·4	62·0	107·0	48·8	63	158
Inland:	Hall's Creek *	29·943	29·968	30·114	29·721	84·3	60·2	73·2	93·2	47·4	91·5	63·3	102·0	47·0	261	2510
	Marble Bar ...	...	...	...	...	95·5	66·7	81·1	106·0	52·8	...	...	...	...	19	527
	Nullagine * ...	29·920	29·962	30·162	29·705	90·9	60·2	75·6	100·5	43·0	90·1	61·7	99·8	41·0	36	392
	Peak Hill ...	29·965	29·986	30·250	29·700	87·0	62·0	74·5	99·0	48·0	83·5	61·5	95·8	48·8	21	78
	Wiluna ...	29·974	...	30·307	29·697	85·9	57·5	71·7	99·2	42·7	...	...	...	...	55	76
	Cue	29·985	30·034	30·280	29·730	87·0	60·2	73·6	102·0	48·0	84·5	59·8	101·0	41·0	3	27
	Yalgoo ...	29·979	30·038	30·247	29·674	86·3	58·1	72·2	100·0	47·0	83·4	58·1	102·5	43·6	5	110
	Lawlers ...	30·024	30·050	30·367	29·727	84·7	60·5	72·6	101·8	43·3	81·0	58·0	98·1	39·4	85	174
	Laverton ...	30·058	30·069	30·431	29·737	83·5	57·6	70·6	100·0	42·6	82·0	56·4	96·9	38·6	57	197
	Menzies ...	30·050	30·077	30·406	29·678	80·1	56·2	68·2	102·0	38·0	78·4	56·0	98·0	37·0	22	70
	Kanowna ...	...	...	...	...	80·1	55·0	67·6	101·0	40·8	...	...	...	...	12	38
	Kalgoorlie ...	30·078	30·098	30·466	29·647	81·2	57·0	69·1	99·9	39·9	77·3	54·7	96·2	39·4	24	82
	Coolgardie ...	30·080	30·092	30·473	29·676	79·8	55·5	67·6	97·5	42·9	77·1	53·8	97·8	38·1	65	146
	Southern Cross	30·069	30·072	30·393	29·703	82·2	52·8	67·5	97·2	37·5	78·3	51·4	98·0	31·7	2	181
	Walebing ...	...	...	...	...	79·6	52·7	66·2	96·0	41·0	...	...	...	...	60	264
	Northam ...	...	...	...	...	81·1	49·9	65·5	91·0	37·5	...	...	...	...	90	369
	York	30·075	30·096	30·370	29·739	79·8	50·4	65·1	95·0	36·2	78·0	51·2	100·2	34·5	119	316
	Guildford ...	...	...	...	...	80·4	52·1	66·2	96·4	35·8	70·7	53·6	90·8	38·2	243	456

* For the first time means of previous years are taken between 1897 (when the Meteorological Service was re-organised) and 1902 (inclusive). All observations prior to 1897 have been rejected, except in the case of the Perth Botanical Gardens.

The Climate of Western Australia during April, 1904—*continued.*

Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Barometer: Average for previous years.	Barometer: Highest for Month.	Barometer: Lowest for Month.	Shade Temperatures. April, 1904. Mean Max.	April, 1904. Mean Min.	April, 1904. Mean of Month.	April, 1904. Highest Max.	April, 1904. Lowest Min.	*Average for previous Six Years. Mean Max.	*Average: Mean Min.	*Average: Highest ever recorded.	*Average: Lowest ever recorded.	Rainfall. Points (100 to inch) in Month.	Rainfall. Total Points since Jan. 1
South-West and South Coast:															
Perth Gardens ...	30·071	30·106	30·361	29·718	77·4	55·6	66·5	93·8	41·6	77·1	54·8	99·0	41·0	291	422
Perth Observatory	30·086	30·097	30·368	29·755	76·7	56·4	66·6	94·8	42·9	75·0	56·4	97·4	42·4	313	452
Fremantle ...	30·094	30·092	30·351	29·781	74·3	59·3	66·8	84·0	48·2	73·2	58·4	93·6	46·4	74	265
Rottnest ...	30·082	30·069	30·357	29·760	73·3	61·6	67·4	82·0	52·0	72·0	60·1	91·0	47·8	62	172
Mandurah ...	...	...	...	...	74·0	...	...	86·0	...	75·3	52·2	93·4	36·8	142	374
Wandering ...	...	...	...	...	79·9	46·3	63·1	92·0	30·2	...	...	...	...	91	243
Narrogin... ...	...	...	...	...	73·0	50·7	61·8	84·5	33·0	...	...	...	...	94	255
Collie	...	...	...	...	73·6	43·5	58·6	86·5	31·2	72·8	43·9	89·1	29·6	192	548
Donnybrook ...	...	...	...	...	74·0	50·1	62·0	85·0	36·8	...	...	...	...	216	735
Bunbury ...	30·095	30·106	30·380	29·770	73·8	53·0	63·4	84·6	42·5	73·0	52·7	89·5	36·7	242	584
Busselton ...	...	...	...	...	72·9	49·0	61·0	80·0	35·0	71·8	49·7	87·3	32·2	141	480
Cape Naturaliste	...	...	...	...	70·3	55·9	63·1	78·0	46·2	...	...	...	...	191	526
Bridgetown ...	...	...	...	...	74·1	44·1	59·1	88·7	31·5	72·6	44·3	90·0	29·5	186	520
Karridale ...	30·035	30·110	30·310	29·690	73·0	49·0	61·0	82·0	37·0	70·4	51·9	92·0	36·6	240	549
Cape Leeuwin ...	30·070	30·070	30·370	29·650	72·1	60·0	66·0	81·3	51·2	68·9	58·8	89·5	49·0	173	487
Katanning ...	30·080	30·098	30·445	29·736	73·0	48·4	60·7	82·5	34·0	72·0	48·4	96·2	33·0	114	356
Albany	30·094	30·100	30·452	29·701	71·2	51·3	61·2	81·6	38·8	68·7	52·6	98·8	39·5	224	645
Breaksea... ...	30·091	30·102	30·450	29·660	69·2	57·4	63·3	81·5	48·8	66·3	56·0	96·4	44·0	156	500
Esperance ...	30·112	30·116	30·514	29·617	74·5	55·8	65·2	90·5	41·5	72·3	54·3	99·0	40·2	119	363
Balladonia ...	30·128	...	30·502	29·756	79·0	53·6	66·3	103·6	42·0	...	...	...	...	81	115
*Eyre**	*30·107*	*30·110*	*30·455*	*29·749*	*77·2*	*56·6*	*66·9*	*105·0*	*34·5*	*73·6*	*55·3*	*100·7*	*36·8*	45	336
INTER-STATE.															
Perth	30·086	30·097	30·368	29·755	76·7	56·4	66·6	94·8	42·9	75·0	56·4	97·4	42·4	313	452
Adelaide	30·186	30·148	30·408	29·550	75·6	58·4	67·0	91·5	47·5	73·4	54·7	98·0	39·6	201	521
Melbourne	30·211	30·025	30·508	29·441	71·3	50·9	61·1	86·9	41·8	68·6	50·6	94·0	34·8	77	364
Sydney	30·240	30·107	30·510	29·730	70·0	59·0	64·5	77·0	53·0	70·8	58·2	88·9	44·6	1,260	2,348
Cocos Island ...	29·914	...	30·000	29·850	86·0	75·0	80·5	91·0	73·0	...	...	...	...	1,277	...

* For the first time means of previous years are taken between 1897 (when the Meteorological Service was re-organised) and 1902 (inclusive). All observations prior to 1897 have been rejected, except in the case of the Perth Botanical Gardens.

The Observatory, Perth, May, 1904.

W. E. COOKE, Government Astronomer.

RAINFALL for March, 1904 (completed as far as possible), and for April, 1904 (principally from Telegraphic Reports).

Stations.	March.		April.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
East Kimberley:				
Wyndham	544	15	315	8
6-Mile	698	14	...	...
The Stud Station	1098	12	...	...
Carlton	896	16	...	...
Denham	...	...	...	...
Rosewood Downs	438	13	...	...
Argyle Downs	620	13	..	...
Turkey Creek	623	11	240	6
Hall's Creek	519	6	261	6
Flora Valley	829	9	...	...
Ruby Plains	718	8	...	...
Denison Downs	...	...	...	...
West Kimberley:				
Obagama	865	13	...	...
Beagle Bay	305	11	...	...
Derby	490	10	517	6
Yeeda	353	9	...	...
Liveringa	525	8	...	...
Leopold Downs	301	10	...	...
Fitzroy Crossing	681	11	507	5
Fitzroy (C. Blythe)	796	5	...	...
Nookanbah	...	...	...	...
Broome	512	8	610	5
Roebuck Downs	...	...	...	...
Thangoo	...	...	...	...
La Grange Bay	175	8	275	6
North-West:				
Wallal	360	6	12	1
Condon	81	4	Nil	...
Pardoo	228	4	...	...
DeGrey River	204	4	...	...
Port Hedland	60	6	9	1
Boodarie	40	3	...	...
Warralong	86	4	...	...
Ettrick	...	...	...	...
Mulgie	343	5	...	...
Eel Creek	373	7	...	...
Station Peake	346	5	...	...
Coongon	168	6	...	...
Warrawagine	117	4	...	...
Bamboo Creek	208	5	52	2
Marble Bar	242	4	19	1
Warrawoona	195	5	69	3
Corunna Downs	211	5	...	...
Nullagine	44	2	36	2

Stations.	March.		April.	
	No. of points. 100 = 1in.	No. of wet days.	No. of points. 100 = 1in.	No. of wet days.
North-West—*cont.*				
Mount Edgar	103	4	...	...
Kerdiadary	20	1	...	...
Roy Hill	27	2	...	...
Middle Creek	30	3	...	...
Mosquito Creek	83	3	...	...
Mulga Downs	43	2	...	...
Woodstock	...	...	...	...
Mt. Florence	183	4	...	...
Tambrey	...	..	...	...
Millstream	99	2	...	...
Mallina	...	...	...	...
Whim Creek	453	5	Nil	...
Cooyapooya	135	3	...	...
Woodbrooke	248	2	...	...
Croydon	239	6	...	...
Roebourne	1	1	Nil	...
Cossack	13	2	Nil	...
Fortescue	20	2	50	1
Mardie	3	1	...	...
Yarraloola	...	...	...	...
Chinginarra	20	1	...	...
Onslow	142	3	Nil	...
Peedamullah	247	3	...	...
Red Hill	254	4	...	...
Mt. Mortimer	106	3	...	...
Peake Station	184	4	...	...
Wogoola	209	3	...	...
Nanutarra	97	4	...	...
Point Cloates	83	4	...	...
Gascoyne:				
Winning Pool	305	3	Nil	...
Coordalia	208	3	...	...
Towara	201	6	...	...
Maroonah	...	...	...	...
Gifford Creek	163	3	...	...
Minnie Creek	126	3	...	...
Williambury	63	4	...	...
Wandagee	138	4	...	...
Bernier Island	56	2	...	...
Boolathana	293	5	...	...
Carnarvon	136	6	15	1
Brick House	39	2	...	...
Doorawarrah	86	4	...	...
Bintholya	98	5	...	...
Mungarra	12	3	...	...
Clifton Downs	33	3	...	...

RAINFALL—*continued.*

Stations.	March. No. of points. 100 = 1in.	March. No. of wet days.	April. No. of points. 100 = 1in.	April. No. of wet days.
Gascoyne—*contd.*				
Dairy Creek ...	48	6	...	...
Upper Clifton Downs	30	4	...	...
Dirk Hartog Island	224	1	...	...
Sharks Bay ...	10	1	10	1
Meedo	124	4	...	...
Tamala	40	1	...	...
Wooramel ...	13	1	12	1
Hamelin Pool ...	26	4	19	1
Byro	26	3	7	1
Yarra Yarra ...	34	2	Nil	...
Berringarra ...	12	2	2	1
Moorarie ...	Nil	...	Nil	...
Wandary... ...	1	1	Nil	...
Peak Hill ...	5	1	21	1
Horseshoe ...	Nil	...	28	1
Abbotts	5	1	10	1
Belele	Nil	...	..	...
Mileura	Nil	...	Nil	...
Milly Milly ...	19	2	Nil	...
Manfred ...	34	2	...	...
New Forest ...	64	2	17	1
Woogorong ...	18	3	...	...
Boolardy ...	Nil	...	...	...
Twin Peaks ...	80	2	4	1
Billabalong ...	67	1	7	1
Wooleane ...	39	4	7	1
Yallalonga ...	75	7	9	1
Meka	48	2	Nil	...
Mt. Wittenoom ...	7	1	Nil	...
Nannine	1	1	4	1
Star of the East...	Nil	...	Nil	...
Annean	24	3	5	2
Coodardy ...	Nil	...	25	1
Cue	24	2	3	2
Day Dawn ...	11	2	7	2
Lake Austin ...	32	3	Nil	...
Lennonville ...	26	3	14	2
Mt. Magnet ...	41	3	5	1
Challa	37	2	...	...
Youeragabbie ...	30	2	40	1
Murrum	103	1	...	...
Burnerbinmah ...	56	4	3	1
Barnong	95	4	25	1
Mellinbye ...	50	3	42	1
Yalgoo	99	5	5	1
Wagga Wagga ...	52	3	Nil	...
Gabyon	41	3	...	...

Stations.	March. No. of points. 100 = 1in.	March. No. of wet days.	April. No. of points. 100 = 1in.	April. No. of wet days.
South-West Division (Northern Part):				
Murchison House	48	1	...	...
Mount View ...	60	1	15	1
Mumby	88	3	65	1
Yuin	22	1	4	1
Northampton ...	90	2	57	1
Oakabella ...	73	1	...	...
Narra Tarra ...	...	...	...	...
Tibradden ...	68	1	...	...
Myaree	53	4	51	1
Sand Springs ...	70	1	...	...
Mullewa... ...	233	5	43	1
Kockatea ...	113	4	Nil	...
Bootenal ...	56	1	...	...
Geraldton ...	91	3	63	2
Greenough ...	58	1	10	1
Dongara ...	90	1	38	1
Dongara (Pearse)	78	1	38	1
Strawberry ...	...	...	...	...
Nangetty ...	45	1	42	1
Mingenew ...	92	5	61	1
Urella	42	1	44	1
Yandenooka ...	58	1	92	2
Rothesay ...	62	1	45	3
Field's Find ...	42	5	11	2
Carnamah ...	60	5	34	1
Watheroo ...	127	4	50	1
Dandaragan ...	305	2	86	2
Moora	208	2	86	2
Yatheroo ...	271	3	98	1
Walebing ...	200	4	60	1
New Norcia ...	384	4	79	3
South-Western Division, Central (Coastal):				
Gingin	128	4	121	2
Belvoir	185	5	180	4
Mundaring ...	260	7	196	5
Guildford ...	190	8	243	4
Kalbyamba ...	105	5	...	...
Canning W't'r'w'ks	143	2	183	3
Perth Gardens ...	105	6	291	6
Perth Observatory	116	7	313	5
Subiaco	104	5	205	5
Fremantle ...	168	9	74	5

RAINFALL—*continued.*

Stations.	March. No. of points. 100 = 1in.	March. No. of wet days.	April. No. of points. 100 = 1in.	April. No. of wet days.
SOUTH-WESTERN—*continued.*				
Rottnest	98	7	62	5
Armadale ...	130	3	178	3
Rockingham ...	123	8	154	6
Jarrahdale ...	182	8	239	4
Mandurah ...	213	7	142	5
Pinjarra	182	3	100	4
Yarloop	294	9	167	5
Harvey	246	9	229	6
Upper Murray ...	...	...	140	3
SOUTH-WEST, CENTRAL PART (INLAND):				
Hatherley ...	174	3	...	...
Dowerin ...	171	2	36	1
Momberkine ...	297	4	115	1
Monglin ...	336	4	71	2
Newcastle ...	509	4	114	1
Eumalga ...	344	4	148	4
Northam ...	279	5	90	1
Grass Valley ...	322	3	81	1
Meckering ...	261	6	68	2
Cunderdin ...	316	3	78	2
Codg-Codgin ...	179	5	37	2
Yarragin ...	132	3	...	...
Doongin	204	3	59	2
Cuttening ...	188	4	...	...
Whitehaven ...	284	4	59	2
Sunset Hills ...	272	3	96	2
Cobham	230	4	120	3
Yenelin	298	3	49	2
York	195	5	119	2
Dalbridge ...	...	...	101	2
Beverley ...	233	4	100	1
Bally Bally ...	266	5	92	4
Barrington ...	234	5	87	1
Stock Hill ...	214	2	85	1
Sunning Hill ...	200	6	...	...
Wandering ...	137	7	91	1
Glen Ern ...	240	7	110	5
Pingelly ...	165	2	90	1
Marradong ...	167	9	100	2
Bannister ...	85	7	91	3
Narrogin ...	128	4	89	4
Narrogin Experimental Farm	156	5	94	5
Wickepin ...	244	4	...	...
Gillimaning ...	189	3	50	2

Stations.	March. No. of points. 100 = 1in.	March. No. of wet days.	April. No. of points. 100 = 1in.	April. No. of wet days.
SOUTH-WEST—*contd.*				
Bunking ...	190	3	81	1
Bullock Hills ...	131	2	...	...
SOUTH-WEST DIVISION (SOUTHERN PART):				
Bunbury ...	277	9	242	6
Collie	322	11	192	7
Glen Mervyn ...	299	8	259	7
Donnybrook ...	455	10	216	5
Boyanup ...	478	10	265	9
Ferndale ...	287	7	303	8
Busselton ...	305	7	141	5
Quindalup ...	246	6	161	5
Cape Naturaliste	294	8	191	5
Lower Blackwood	320	11	355	8
Karridale ...	215	10	240	9
Cape Leeuwin ...	185	10	173	11
Biddellia ...	341	10	276	7
The Warren ...	312	10	338	9
Lake Muir ...	188	7	...	...
The Peninsula ...	279	11	201	10
Mordalup ...	191	8	...	...
Deeside	184	9	104	5
Riverside ...	199	9	117	7
Balbarup ...	236	8	189	6
Wilgarup ...	172	8	218	7
Bridgetown ...	297	11	186	6
Westbourne ...	232	9	135	6
Hilton	335	7	101	3
Greenbushes ...	334	8	299	5
Greenfields ...	420	9	...	...
Glenorchy ...	227	7	118	6
Williams ...	100	3	56	2
Arthur	259	7	62	2
Darkan	...	...	64	3
Wagin	167	5	102	5
Glencove ...	162	4	83	5
Dyliabing ...	143	5	75	5
Katanning ...	227	7	114	6
Kojonup ...	221	6	148	8
Broomehill ...	203	6	73	5
Sunnyside ...	177	6	76	7
Woodyarrup ...	177	6	81	4
Mianalup ...	178	7	62	4
Cranbrook ...	141	8	82	5
Toolbrunup ...	156	6	38	4
Tambellup ...	...	...	106	8
Blackwattle ...	140	3	...	...

RAINFALL—*continued.*

Stations.	March. No. of points. 100 = 1in.	March. No. of wet days.	April. No. of points. 100 = 1in.	April. No. of wet days.
South-West—*contd.*				
Woogenellup ...	199	7	95	6
Mt. Barker ...	201	8	125	7
Kendenup ...	222	10	135	8
St. Werburgh's ...	161	9	151	7
Forest Hill ...	213	12	...	...
Denmark ...	201	7	170	4
Grassmere ...	301	10	201	9
Albany	306	11	224	14
King River ...	304	8	165	6
Point King ...	322	8	181	9
Breaksea ...	237	11	156	18
Cherilallup ...	143	3	...	...
Pallingup ...	207	4	...	...
Bremer Bay ...	335	11	78	5
Eastern Division:				
Dural	20	1	...	...
Wiluna	17	4	55	1
Gum Creek ...	100	1	43	2
Mt. Sir Samuel ...	21	2	22	2
Lawlers	79	3	85	2
Leinster G.M. ...	55	4	107	2
Darda	37	2	41	2
Mt. Leonora ...	43	5	11	2
Mt. Malcolm ...	30	2	2	1
Mt. Morgans ...	97	2	102	1
Burtville ...	138	2	...	...
Laverton ...	125	4	57	3
Murrin Murrin ...	63	2	21	1
Yundamindera ..	64	3	26	1
Tampa	12	1	18	2
Kookynie ...	47	4	3	1
Niagara	16	2	Nil	...
Yerilla	26	2	Nil	...
Edjudina ...	40	4	53	3
Menzies	46	4	22	3
Mulline	53	1	Nil	...
Waverley ...	79	6	12	1
Goongarrie ...	51	3	5	1
Mulwarrie ...	83	4	4	1
Bardoc	30	2	Nil	...
Broad Arrow ...	23	2	10	1
Kurnalpi ...	19	2	6	1
Bulong	23	2	25	1
Kanowna ...	26	3	12	1
Kalgoorlie ...	54	4	24	1
Eastern—*contd.*				
Coolgardie ...	80	4	65	2
Burbanks ...	87	3	28	1
Woolubar ...	45	4	...	...
Widgiemooltha ...	53	5	50	2
50-Mile Tank ...	90	3	142	3
Waterdale ...	60	5	...	...
Norseman ...	59	3	131	4
Lake View ...	91	2	90	5
Bulla Bulling ...	100	5	34	2
Boondi	212	5	57	3
Boorabbin ...	163	4	43	4
Koorarawalyee ...	187	5	10	1
Karalee	185	3	39	2
Southern Cross ...	165	1	2	1
Parker's Range ...	222	5	39	5
Parker's Road ...	165	1	48	2
Mt. Jackson ...	113	5	11	1
Bodallin ...	215	2	13	1
Burracoppin ...	176	2	57	2
Kellerberrin ...	206	4	37	2
Merredin ...	112	2	40	1
Nangeenan ...	...	...	37	1
Mangowine ...	219	4	...	...
Wattoning ...	57	1	...	...
Eucla Division:				
Ravensthorpe ...	199	7	75	9
Coconarup ...	160	6	83	5
Hopetoun ...	148	7	99	7
Park Farm ...	233	6	86	2
Esperance ...	199	7	119	9
Gibson's Soak ...	265	5	99	6
30-Mile Condenser	251	6	77	5
Swan Lagoon ...	222	6	31	3
Grass Patch ...	204	7	39	6
Myrup	225	6	151	9
Lynburn ...	338	5	...	...
Boyatup	210	5	...	...
Point Malcolm ...	418	8	...	...
Israelite Bay ...	347	5	198	9
Balbinia	122	8	...	...
Frazer Range ...	47	3	...	...
Balladonia ...	34	4	81	2
Southern Hills ...	58	3	...	...
Eyre	228	8	45	5
Eucla	80	7	137	10

The Observatory, Perth,
11th May, 1904.

W. E. COOKE,
Government Astronomer.

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NOTES.

FUMIGATION TENTS.—It is notified that the whole of the tents mentioned in the last issue of the *Journal* as being for sale are now disposed of.

REPORTS.—In this issue we publish three interesting reports from Mr. Berthoud, of the experimental plots at Hamel, on cereals, maize, and potatoes.

LECTURES.—Owing to the want of room in the Museum, the second and all subsequent lectures will be given in the old Legislative Council Chambers, opposite St. George's Cathedral, St. George's Terrace.

POULTRY SHOW.—We have been asked to call attention to the date fixed for the holding of the West Australian Dog and Poultry Society's annual show, which is to take place on June 30, July 1st and 2nd, and will be held in the skating rink, Hay-street, East.

HOW TO IMPROVE THE HERD.—What every dairyman can do to improve his herd is to test individual cows and dispose of such as do not come up to a profitable standard. This standard will vary in different localities, depending on the cost of feed and labour and on the value of the products.

A STRAWBERRY PLANTATION.—In this issue we publish a photograph of Mr. Urch's strawberry plantation at Kalamunda, Upper Darling Range. Berry-growing in this district is proving to be a most profitable industry, and quite a number of settlers are taking it up. The illustration gives one but a faint idea of the extent that strawberry culture is indulged in on the Ranges.

SHARPS FOR PIGS.—You should give your pigs some sharps or toppings with the skimmed milk, and once a day some peas in a dry state should be given. After they have received this food for a time a little barley meal may be added to the milk and sharps; but this must be given in small quantities at first, or the pigs will be surfeited. Milk, when mixed with the above articles and the ordinary house-wash added, may be given in sufficient quantity that the previous lot is cleared up before the next feeding time.

FOOD FOR SHEEP.—Roots in excess are bad for ewes in lamb. If carted out to them into grass lands or stubbles in limited quantity, say, 12 to 15 cwt. of roots per hundred ewes, they will do no harm. Ewes thus fed should have hay, and access to sweet barley, or oat straw, and water, and, where circumstances allow, a run over sound grass land. It is well known that a restricted supply of roots and a liberal supply of dry fodder are the proper conditions for keeping a ewe flock healthy.

ENQUIRY COLUMN.—It having been suggested by a correspondent that an enquiry column established in connection with the *Journal* would be of considerable benefit to subscribers, the Editor of the *Journal* will be pleased to reserve a page for the purpose of answering questions of public interest on agronomic matters. All enquiries should be addressed to the Director, Department of Agriculture, Perth, and should be accompanied by the name and address of the enquirer—not necessarily for publication. All enquiries of sufficient public interest will be answered on this page by the officers of the Department.

CLEANING THE PLOUGH.—A good plan for cleaning the plough, which will also work well on other tools of iron and steel, is as follows:—Slowly add one pint of sulphuric acid to one quart of water, handling it carefully and stirring slowly, as considerable heat will result from the mixing. When cool moisten the surface of the metal with this, and then rub dry, after which wash off with pure water. This application should clean any surface not too badly rusted, but if the tool has been long neglected it may require more than one application. After cleaning, a thorough coating of grease is given before putting a tool away, and when taken out to use give another greasing, and it will go another horse easier. Not only is it much easier for team but ploughman also.

FORAGE PLANTS.—Mr. J. Hawter, of the Blackwood Nurseries, in a report to the Director of Agriculture on the experimental growth of forage plants, says:—"I am pleased to state that the following valuable conclusions were arrived at, viz., that for the

Mr. Urch's strawberry plantation, Kalamunda.

light loamy soil on which the the test was carried on, the Hungarian Forage Grass and Cocksfoot gave the best results, both rooting deep, stooling and spreading vigorously. Kentucky Blue Grass is also very hardy, but not so vigorous. *Paspalum dilitatum* and *P. virgatum* both are now doing remarkably well, but they were a long while making a start. At present the finest grasses are undoubtedly the Perennial Rye Grass and crimson and white clover; these all suffered during the hot summer months, fully half the plants dying. It is also interesting to know that, although so far inland, the saltbush, *Atriplex semibaceata,* sown in poor loose hilly ground, is thriving very well indeed. I am now trying it in a poor part of a paddock where only scrub and jarrah will grow at present. Providing the seed would germinate when sown in paddocks, after the autumn burning off, without any cultivation, then this plant should add considerably to the carrying capacity of our waste lands for sheep. Sorghum did very well, especially Dhourra and Early Amber Cane. Hungarian and Pearl Millets require richer land and, I think, more moisture. The same applies to the different maize, of which the best for green fodder was Austin's Colossal and Hickory King.

BLOW FLY ON SHEEP.—A correspondent sends us the following:—"Following the unprecedented and disastrous drought, it is the misfortune of pastoralists to encounter yet another serious drawback to their interests in the form of the blow fly. It is common knowledge that this comparatively new pest has suddenly developed into a most serious scourge over extensive areas in this State, attacking a large number of flocks, especially the lambing ewes. Of all the pests of sheep, the blow fly, unless checked, is the most rapidly destructive. Our acquaintance with it in the British Isles, where it has always largely prevailed, extends over sixty years, therefore we can fairly claim a most thorough and practical knowledge on the subject, and our experience generally is that, whilst flocks can be effectually protected from this pest by means of dipping, this preventive being neglected, every sheep that is struck must be hand-dressed, necessitating enormous labour. The only alternative is their certain destruction, for this formidable pest is capable of destroying sheep within a few days after first striking them. Various dipping preparations are more or less efficacious in preventing maggot fly. In the British Isles this has long been generally recognised to be the unfailing remedy. On Quambone Station, near Coonamble, a month after last shearing, all the sheep were dipped, including 20,000 ewes, with the result that they are practically free from the fly. The owners afterwards purchased 6,000 ewes, which had not been dipped, and fully 25 per cent. of these have since become badly affected; and, mark this fact, *all these sheep have been running on the same country.* The immediately adjoining neighbours state they have had to hand-dress about the same proportion of their sheep, which were not dipped."

STATE FARM, HAMEL.

SEASON 1903-4.

Report on Potatoes Grown on State Plots, Hamel.

By G. F. BERTHOUD.

POTATOES.

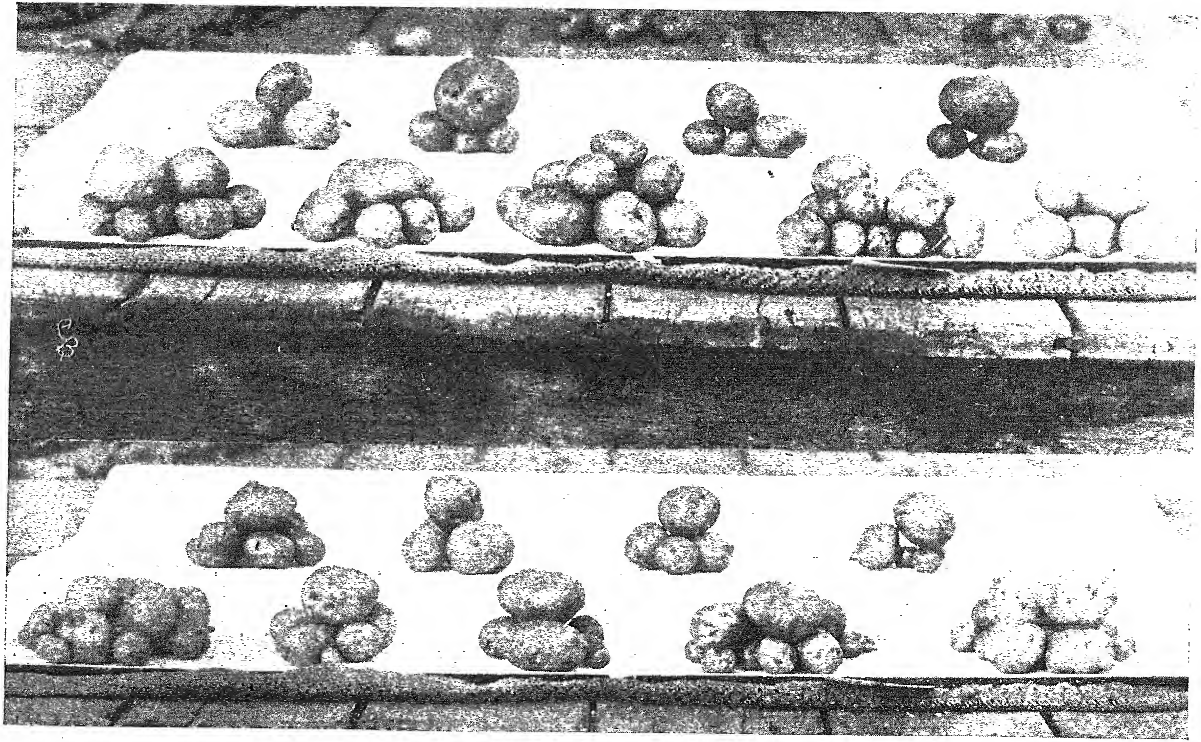
During the past season only a few imported varieties were grown on small trial plots. The yields from these were, on the average, light, not equal to the standard sorts, Beauty of Hebron and Early Rose. Two kinds only produced really nice, clean, marketable tubers, viz., Sutton's Epicure and Jersey Kidney. The varieties numbered one to 11 were imported from England, and kindly supplied for trial by Mrs. Fawcett of Pinjarra. The tubers were planted whole, in drills two feet apart and three feet between the rows. Fertilisers used at the rate of six cwts. per acre. Soil low, land close to the brook, which retained fair moisture during the whole period of growth. Although twice sprayed with Bordeaux mixture, the foliage became spotted with disease early in March. The plants were then taken up before the tubers were fully matured. This decreased the yields slightly.

No. 1: *Sutton's Abundance.*—Planted 9th November; germination even and good; growth very vigorous; healthy dark green foliage; stalks strong and upright; height to two feet nine inches; flower white; taken up 7th March; tubers large, oblong or pebble shape; colour white; fair variety. Yield at the rate of three tons per acre.

No. 2: *Sutton's May Queen.*—Planted 9th November; germination even; growth rather weakly; foliage inclined to fungus disease; height 18 inches; early variety, but not very promising for this locality; taken up 7th March; tubers large, white, kidney shape. Yield at the rate of two and three-quarter tons per acre.

No. 3: *Sutton's Epicure.*—Planted 9th November; germination good; growth fair; stalks strong; foliage affected with fungus disease; height to two feet; early variety; taken up 7th March; tubers large, round, white, clean, and even in size. Yield at the rate of three tons per acre. Good variety.

No. 4: *Sutton's Ideal.*—Planted 9th November; germination good; growth slow, but fairly healthy; stalks weakly; foliage dark green; height to two feet; taken up 7th March; tubers white, round to oblong in shape. Yield poor, at the rate of two and a half tons per acre.



Potatoes grown from Seed at Experimental Plots, Hamel.

No. 5: *The Sutton.*—Planted 9th November; germination good; growth fairly vigorous; foliage inclined to leaf disease; stalks strong; height 18 inches; taken up 7th March; tubers fair, even size, round; colour light pink. Yield light, at the rate of two and a half tons per acre. This variety produces seed balls freely.

No. 6: *Sutton's Reliance.*—Planted 9th November; germination even; growth fair and healthy; habit of plant bushy and spreading close to the ground; height to 18 inches; taken up 7th March; tubers white, oblong, misshaped, scabby, and poor. Yield at the rate of two and three quarter tons per acre.

No. 7: *Sutton's Windsor Castle.*—Planted 9th November; germination even; growth vigorous: plants stand up nicely; stalks strong: foliage dark green and healthy; height to two feet; taken up 7th March; tubers round, white, small, and poor. Yield light, at the rate of two and a half tons per acre.

No. 8: *Sutton's Ninety Fold.*—Planted 9th November; germination good; growth fair; stalks strong and upright; height to two feet; plants were attacked, however, badly with fungus leaf disease; taken up 7th March; tubers large, oblong, white, few small ones; prolific variety. Yield at the rate of five tons per acre. Good variety.

No. 9: *Sutton's Satisfaction.*—Planted 9th November; germination good; growth fairly strong and healthy; height to two feet six inches; flowers pale lilac; taken up 7th March; tubers small, white, round; sample rather poor for market. Yield at the rate of three tons per acre.

No. 10: *Sutton's Centenary.*—Planted 9th November; germination even; growth healthy and fine; height to 18 inches; taken up 7th March; tubers white, pebble shape, medium size, poor and scabby. Yield light at the rate of two and three-quarter tons per acre.

No. 11: *Sutton's Early Regent.*—Planted 9th November; germination good; growth slow and weakly; plants dwarf but fairly healthy; height to 15 inches; taken up 7th March; tubers small, white, round; poor market sample. Yield light, at the rate of two and a-half tons per acre. Poor variety.

No. 12: *Murta* (Chilian variety).—Planted 9th November; growth healthy and vigorous; habit of plant spreading; stalks fairly strong; foliage deep green; height to 18 inches; late variety; taken up 7th March; tubers small, round, white. Yield at the rate of three tons per acre. Sample uneven. Poor for market.

No. 13: *Jersey Kidney.*—Imported seed kindly supplied for trial by Mr. C. Harper, of Woodbridge, Guildford; seed tubers sound and good; planted 16th February; germination good, fairly even; growth upright; single stalk; strong foliage, healthy; height to 18 inches; taken up 17th May; tubers of medium size,

oblong; skin white, clean and smooth; eyes shallow. Yield at the rate of three tons per acre. Promising variety for further trial.

No. 14: *Northern Star.*—Imported two pounds of this new potato from Messrs. Dobbie and Co., Rothesay, Scotland. This variety originated with the celebrated raiser of new potatoes, Mr. A. Findlay, of Markinch, Scotland. Tubers large, white and round; said to be highly resistant to disease; tubers planted whole on arrival 19th March; germination very quick and even; growth strong, healthy and promising. However, the plants were badly damaged by heavy hailstorm in May. Not taken up at time of writing.

SEEDLINGS.

Local seed saved from fertilised balls of the strong-growing German variety, Dr. Von Lucius, sown in boxes under glass 9th November; germination even; young plants set out early in December in prepared bed in the open ground. Growth of most plants strong and healthy and free from disease. Height to 18 inches. Nearly all the plants flowered freely. Colour, white to lilac-blue. Varieties numerous, early, medium, and late. Tubers round to long, white, pink, and red. Taken up end of March. Yield good up to 26 tubers per plant; largest tuber weighed three and a quarter ounces. Over 100 plants were selected for planting early in spring.

The object of raising new kinds of potatoes from seed is to obtain varieties of strong growth, hardy, and better adapted to our climate than the imported sorts. So far the work is very interesting, and several of the seedlings are promising. These, after further culture and careful selection, may prove to be valuable. I have another lot of choice seed which will be sown early in spring.

Report on Cereals, State Farm, Hamel.

The past season proved to be very unfavourable for the profitable culture of grain crops in this locality, chiefly owing to excessive rainfall during the months of July, August, September, and part of October. Except on well drained places, the surface water perished the rootlets thoroughly, so injuring the plants that they produced only a few weakly stocks and badly filled ears. The high land or easterly winds which prevailed here in November and December shelled the grain even before it was fully mature, thereby still further reducing the yields.

Yields are taken from two chains of an average drill in each plot; these are threshed and weighed carefully; they are, therefore, fairly reliable and show the productiveness of each kind. The average returns are the lowest yet seen here.

Soil.—Low land, brown loam of fair quality, but requires to be more fully drained to obtain good results in wet years.

Culture.—All plots sown in drills with fertiliser applied at the rate of 2cwt. per acre. Owing to surface water the good effects of the manure were partly washed out before the young plants derived much nourishment. Best varieties for grain and hay in the South-West; the following are reliable wheats:—White Lammas, Tardent's Blue, Lucky Talavera. For superior hay "Minnesota 169" is the best of all.

Oats.—Algerian is a good all round sort.

For dry climate grain; wheat, Alpha X Bred 73 Steinlee; oats, early ripe, No. 23; barley, nepaul.

WHEATS.

Italian Red.—Imported seed; sown 19th May; germination fair; growth very uneven; straw good, stands up well; height to four feet; ripe 21st December; ears long, thin, and heavily bearded; holds grain well. Yield at the rate of: grain, four bushels; straw, $9\frac{1}{2}$cwt. per acre; kernel red, long, and thin. Not a desirable variety.

Champlan.—Local seed; sown 19th May; germination good; growth fairly even; this variety stands the wet better than some others; height to four feet; ripe 25th December; ears beardless, well filled; liable to shell grain in rough weather. Yield at the rate of $12\frac{1}{2}$ bushels per acre, straw 14cwt.; grain plump, of a pale red colour; good late variety for the South-West.

Tardent's Blue.—Local seed; sown 22nd May; germination good; growth uneven owing to excess of rain; height to four feet six inches; ripe 20th December; ears of good size; chaff velvety; shells grain badly during rough weather. Yield at the rate of 14 bushels, and straw 20cwt. per acre; grain fair size, of a pale yellow colour; good late wheat for hay or grain.

Galland's Hybrid.—Local seed; sown 23rd May; germination good; growth uneven and badly damaged by wet; ripe 25th December; heavy well-filled, bearded ears; very prolific variety on well-drained land. Yield at the rate of: grain, nine bushels; straw, $11\frac{3}{4}$cwt. per acre; large white grain; good late variety for poultry feeding.

Chettle's Excelsior.—Local seed; sown 27th May; germination good; growth slow, very uneven; height to three feet; ripe 29th December; ears beardless, of good size and shape; holds grain well. Yield at the rate of: grain, $4\frac{3}{4}$ bushels; straw, $9\frac{1}{2}$cwt. per acre. Not a desirable variety. Grain yellow and plump.

Fife Essex.—Local seed; sown 28th May; germination good; growth poor and uneven, owing to wet; height to five feet; straw fine and clean; ripe 20th December; ears small and beardless; holds grain well. Yield at the rate of: grain, $5\frac{1}{4}$ bushels; and straw, 9cwt. per acre. Small white grain.

Farrer's 12-6 x 13-6 (Type B).—Local selected seed; sown 29th May; germination good; growth fair; straw fine, good for hay; plot very patchy; height to four feet nine inches; ripe 28th December. Yield at the rate of 11 bushels; straw, $12\frac{1}{2}$cwt. per acre. Fair grain.

X bred 89.—Local seed; sown 6th June; germination good; growth fairly even and tall; straw clean, fair for hay; height to four feet. Ripe 18th December. Yield at the rate of $7\frac{1}{2}$ bushels; straw, 9cwt. per acre. Pale yellow grain of medium size.

Farrer's 113a.—Local seed; sown 29th May; germination good; growth dwarf but fairly even; height to three feet six inches; straw stiff, stands up very well; ripe 20th December. This is a distinct Australian wheat of excellent milling quality. Yield at the rate of: grain, 15 bushels; straw, $10\frac{3}{4}$cwt. per acre. Grain small and white. Good wheat for South-West District.

Lots.—Seed from York district; sown 1st June; germination uneven; growth poor owing to wet; height three feet six inches; very patchy; ripe 20th December; ears of good shape, holds grain well. Yield at the rate of $11\frac{1}{2}$ bushels; straw, at the rate of $11\frac{1}{4}$cwt. per acre. Good grain of a pale yellow colour.

X bred 88a.—Local selected seed; sown 2nd June; germination good; growth uneven and poor; ripe 20th December; ears of fair size, holds grain well. Yield at the rate of: grain, eight bushels; and straw, $10\frac{1}{2}$cwt. per acre. Grain of a medium size, yellow in colour.

White Tuscan.—Local seed; sown 3rd June; germination even; growth fairly level; height to four feet; straw clean, good for hay or grain; ripe 20th December; ears of good size, holds grain well. Yield at the rate of: grain, nine bushels; straw, 14cwt. per acre. Plump white grain. Good variety for South-West District.

Farrer's Lucky Talavera.—Local seed; sown 3rd June; germination good; growth fairly level to four feet six inches; straw clean and fine; ripe 20th December; ears of fair size, holds grain well. Yield at the rate of: grain, $15\frac{1}{2}$ bushels; straw, 22cwt. per acre. Grain red and plump; good late wheat for hay and grain in South-West District.

X bred 172.—Local selected seed; sown 5th June; germination good; growth poor and very patchy; straw purple; ripe 20th December; ears of fair size, hold grain well. Yield at the rate of: grain, 15 bushels; straw, $13\frac{1}{4}$cwt. per acre. Grain large, yellow; not a desirable variety.

Minnesota 169.—Local seed; sown 5th June; germination good; growth fairly even, height to five feet; straw clean and fine; very suitable for hay; ripe 28th December; ears medium size; chaff velvety; shells grain easily. Yield at the rate of: grain, 10 bushels; straw, 17cwt. per acre. Grain small, red, good milling quality; one of the very best for hay in South-West District.

Lambrigg White Lammas.—Sown 5th June; germination good; growth fairly level, height to four feet six inches; straw clean; good for hay; ripe 21st December; ears of good shape, large and well filled, hold grain well. Yield at the rate of: grain, 17 bushels; straw, $22\frac{1}{4}$cwt. per acre; grain large, white. First-class variety for grain or hay in South-West District.

Lambrigg Australian Talavera.—Local seed; sown 9th of June; germination good; growth uneven, owing to wet; height to four feet; straw fair quality; ears of nice size; shells grain badly in rough weather; ripe 19th December. Yield at the rate of: grain, $13\frac{1}{4}$ bushels; straw, $14\frac{3}{4}$cwt. per acre; not a desirable variety, owing to shelling grain.

Ranjit.—Local seed; sown 11th June; germination good; growth very uneven; height to three feet six inches; straw weak, liable to lodge; ears long, holds grain very well; hard to thresh; ripe 12th December. Yield at the rate of: grain, $12\frac{1}{2}$ bushels; and straw, $11\frac{1}{4}$cwt. per acre. Grain long, yellow; fair variety for dry districts; unsuitable here.

Plover (Farrer's).—Local seed; sown 12th June; germination good; growth fair; height to three feet six inches: straw firm, stands up well; ears large, beardless, and well filled; holds grain well; ripe 18th December. Yield at the rate of: grain, 13 bushels; straw, $11\frac{1}{2}$cwt. per acre. Grain of a bright yellow colour, medium size.

Bluestem.—Local seed; sown 15th June; germination good; growth slow, but fairly even; straw clean, stands up well; height three feet six inches; ripe late, 28th December. Yield at the rate of: grain, 11 bushels; straw, 12cwt. per acre. Grain small red; good milling quality.

Mold's Red.—Local seed; sown 15th June; germination even; growth very slow and patchy owing to plot being very wet; ripe 30th December; height two feet six inches; ears small and poor. Yield at the rate of: grain nine and a-quarter bushels, straw 13 cwt. per acre. Grain small, red; late. Not a desirable variety.

Xbred 167.—Local selected seed; sown 17th June; germination good; growth uneven; height to three feet six inches; ears long; shells grain badly; ripe 19th December. Yield at the rate of: grain $10\frac{1}{4}$ bushels, straw 11 cwt. per acre; grain long, white and thin. Not desirable owing to shelling.

Doon.—Sown 17th June; germination fair; growth patchy; height to three feet six inches; straw stands up well; ripe 25th December. Yield at the rate of: grain 10 bushels, straw nine cwt. per acre; ears small; holds grain well; kernels yellow and plump.

Silver King.—Local seed; sown 18th June; germination good; growth fairly even; height to three feet six inches; ripe 20th December. Yield at the rate of: grain 11 bushels, straw 13 cwt. per acre; kernels medium size, yellow.

Queen's Jubilee.—Local selected seed; sown 19th June; germination good; growth uneven and poor; ears of fair size; holds grain well; height to three feet; ripe 17th December. Yield at the rate of: grain $10\frac{1}{2}$ bushels, straw eight and three-quarter cwt. per acre; grain medium size, yellow. Not suitable for wet land.

Brodie's Prolific.—Local seed; sown 20th June; germination good; growth fairly even; height to four feet; ripe 18th December; ears well filled. Yield at the rate of: grain 12 bushels, straw $12\frac{3}{4}$ cwt. per acre; grain medium size, yellow. Fair variety.

Bob's (Farrer's).—Imported seed; sown 24th June; germination good; growth even and fine; ears of fair size, nice form, and beardless; height three feet six inches; ripe 18th December. Yield at the rate of: grain seven and a-quarter bushels, straw seven cwt. per acre; kernels small and white. Good new variety.

John Brown (Farrer's).—Imported seed; sown 24th June; germination even, growth fine and level; height to three feet nine inches; ripe 20th December; ears thin and pointed; straw clean, stands up well; chaff brown; does not shell grain. Yield at the rate of: grain six and a-quarter bushels, straw seven cwt. per acre; kernels plump, of medium size, white. Fair new variety.

Power's Fife (Farrer's selection 2/h).—Local seed; sown 24th June; germination even; growth fairly level; height to three feet six inches; straw fine, and good for hay; ripe late, 28th December. Yield at the rate of: grain six and a-half bushels, straw seven and a-half cwt. per acre; kernels small, red. Good milling wheat.

Farrer's 60/a/ x 61/a/ Withney Fife.—Imported seed; sown 24th June; germination even; growth level; height to four feet; straw of good quality for hay; ears long and thin; ripe late, 29th December. Yield at the rate of: grain six and a-half bushels, straw nine cwt. per acre; kernels small, red. Good milling wheat.

Farrer's Plover.—Imported seed; sown 24th June; germination good; growth even and fine; straw stands up nicely; ears of fair size; holds grain well; height to three feet nine inches; ripe 22nd December. Yield at the rate of: grain seven and a-quarter bushels, straw eight cwt. per acre; kernels medium size, bright yellow. Good variety.

Farrer's 10/6/ x 11/6.—Local seed; sown 24th June; germination good; growth fairly even; fine straw, stands up well; ears of fair size, holds grain well; height to four feet; ripe late, 28th December. Yield at the rate of: grain eight bushels, straw nine cwt. per acre; small, red, plump kernel. Good milling wheat.

Farrer's 62/a.—Local seed; sown 24th June; germination even; growth healthy and fairly level; straw of good quality; ears small and thin; height to three feet six inches; ripe late, 28th December. Yield at the rate of: grain eight and a-half bushels, straw nine cwt. per acre; small red kernel.

Yellow Bluestem.—Local selection; sown 24th June; germination strong; growth very even; straw good for hay, of a deep yellow when mature; ears long and thin; brown chaff; holds grain well; height to four feet six inches; ripe late, 25th December. Yield at the rate of: grain eight and a-half bushels, straw nine cwt. per acre; kernels medium size, colour red and yellow.

Speltz or Dinkel.—Local seed; sown 24th June; germination even; growth very good; straw fine and clean; colour, when mature, purple; heads very long and thin; height four feet three inches; ripe late, 29th December. Yield at the rate of: grain 11 bushels, straw nine cwt. per acre; late, hardy variety. Suitable for hay only.

Cross-bred 100.—Selected seed; sown 24th June; germination good; growth healthy, and fairly even; ears short, well filled; holds grain well; straw fair, of a pale purple colour; height to four feet; ripe 16th December. Yield at the rate of: grain seven and a-half bushels, straw six cwt. per acre; yellow kernel, of medium size.

Rerraf.—Local seed; sown 6th July; germination quick and even; growth poor and patchy owing to wet; straw thin and weak; ears small; holds grain well; height three feet; ripe 16th December. Yield at the rate of: grain nine bushels, straw six cwt. per acre; good variety for dry districts; kernels small, white.

Steinlee.—Local seed; sown 7th July; germination quick and vigorous; growth very uneven; straw tinted purple; heads small, but well filled; holds grain fairly well; height to three feet; ripe early, 17th December. Yield at the rate of: grain eight bushels, straw seven and a-quarter cwt. per acre; medium-sized white kernel.

Farrer's 1/j.—Local seed; sown 8th July; germination good; growth very poor and thin; straw slim; ears small, holds grain well; height to two feet six inches; ripe early, 16th December. Yield at the rate of: grain eight bushels, straw seven cwt. per acre; kernels of a pale yellow colour. Suitable for dry climates only.

Farrer's 62/f.—Local seed; sown 9th July; germination even; growth poor and patchy; height to three feet; ripe 25th December. Yield at the rate of: grain 10 bushels, straw nine and a-half cwt. per acre; medium-sized yellow kernel.

Marshall's No. 3.—Local seed; sown 9th July; germination good; growth fairly even; straw good, stands up nicely; height to three feet; ripe 26th December. Yield at the rate of: grain $10\frac{1}{2}$ bushels, straw eight and a-half cwt. per acre; kernels small, yellow.

Crossbred 73.—Local seed; sown 10th July; germination good; growth uneven, stands up well; ears thick and short, well filled; shells easily when fully ripe; height to three feet; ripe early, 14th December. Yield at the rate of: grain 10 bushels, straw seven cwt. per acre; kernels white and plump. Good for dry districts.

Farrer's 43/C.—Local seed; sown 11th July; germination good: growth uneven: straw stands up nicely; ears of fair size; holds grain well; height to three feet; ripe 25th December. Yield at the rate of: grain 10 bushels, straw seven cwt. per acre; kernels small, white.

Alpha.—Local variety of seed: sown 11th July; germination vigorous; growth fairly good, except in low, wet patches; ears of fair size; holds grain well; height three feet six inches; ripe early, 13th December. Yield at the rate of: grain $10\frac{1}{4}$ bushels, straw seven cwt. per acre: kernels large, white. Good early new wheat for dry climates.

Toby's Luck.—Local seed; sown 11th July; germination even; growth fair: ears three inches long, well filled; chaff velvety; holds grain well: height three feet; ripe early, 10th December. Yield at the rate of: grain eight and a-quarter bushels, straw seven cwt. per acre. The type of this valuable new wheat is not yet fixed. Should make a good wheat for dry places.

Crossbred 77.—Local seed; sown 13th July; germination even; growth poor and weak owing to wet; straw fairly good; ears large; shells grain easily; height to three feet; ripe 25th December. Yield at the rate of: grain six and a-half bushels, straw six cwt. per acre; kernels long and thin.

Farrer's 65 f.—Local seed; sown 13th July; germination good; growth poor and uneven owing to wet; height to three feet; ripe 26th December. Yield at the rate of: grain 10 bushels, straw seven and a-half cwt. per acre; kernels yellow, of a fair size.

Crossbred 63.—Local seed; sown 13th July; germination good; growth poor and spoiled by wet; height to three feet; ripe 28th December. Yield at the rate of: grain 10 bushels, straw seven cwt. per acre; kernels yellow and plump.

Field Marshall.—Local seed; sown 18th July; germination even but slow; growth fairly good, except where damaged by wet and birds; height to three feet; ears large, holds grains well; ripe 25th December. Yield at the rate of: grain 11 bushels, straw six cwt. per acre; plump amber-coloured kernel. Good variety for South-West District.

BARLEY.

Nepaul (Indian variety).—Local seed; sown 18th July; germination quick and vigorous; growth healthy and even; straw stout, very sweet; suitable for green feed; grain huskless in appearance, very like wheat; ears short and thick; beardless; height; should be excellent for poultry feeding in dry districts; ripe early, 9th December; fairly productive.

RYE.

Summer Saxon.—Local seed; sown 14th July; germination even; growth good; height to five feet; ears long well filled; straw

of good quality; ripe 28th December; fairly prolific and one of the best sorts grown here.

Rye Giant.—Local seed; sown 14th July; germination good; growth very patchy owing to wet; straw strong; ears large, badly filled; height four feet six inches; ripe late, 30th December. Yield poor.

OATS.

Algerian.—Local seed; sown 18th July; germination even; growth very short but healthy; height to three feet; fair heads; holds grain well; ripe 20th December. This plot was damaged by birds. Yield at the rate of: grain 16 bushels, and straw 11 cwt. per acre.

Golden Fleece.—Local seed; sown 18th July; germination even; growth good, fairly level; straw coarse; good heads; height four feet; ripe 26th December. Plot badly thinned by birds. Yield at the rate of: grain 14 bushels, straw 11 cwt. per acre; kernels yellowish white, long and thin.

Garton's C.—Local seed; sown 14th July; germination even; growth very uneven, owing to young plants being pulled up by birds; straw badly broken down by high winds; height to three feet; ripe 28th December. Yield at the rate of: grain 12 bushels, straw nine and a-quarter cwt. per acre. Heavy white grain.

Garton's B.—Local seed; sown 15th July; germination even. Plot spoiled by birds. Growth very patchy; straw coarse; stands up fairly well, better than the last variety (Garton's C.); height to three feet; ripe 28th December. Yield at the rate of: grain 14 bushels, straw 10 cwt. per acre; kernels plump and of a pale yellow colour.

Oats Huskless, "Avena nuda."—Local seed; sown 15th July; germination good; growth fairly level; height three feet; useful variety for poultry feeding and hay; ripe 20th December. Yield at the rate of: grain eight bushels, straw nine cwt. per acre; grain white and huskless; plot damaged by water.

Oats, "23."—Local seed; sown 16th July; germination fair; growth very patchy; badly damaged by birds; good heads; height two feet six inches; ripe 18th December. Yield at the rate of: grain 15 bushels, straw nine cwt. per acre; kernel fairly plump, of a grey colour. Good early variety.

Early Ripe.—Local seed; sown 17th July; germination good; growth fairly level, but badly pulled about by birds; good heads, liable to shell during high winds; height three feet; ripe 16th December. Yield at the rate of: grain 12 bushels, straw nine cwt. per acre. Good variety for dry districts.

Report on Maize, Test Plots, State Farm, Hamel.

MAIZE.

The past season proved to be a very favourable one for the successful growth of this crop. Owing to the heavy rainfall late in the spring the soil retained sufficient moisture to enable the grain to fill out well. The yields are the best obtained here for several seasons.

Maize when grown for grain should be sown in good soil only, which will retain fair moisture during the whole period of growth; otherwise the results will be unsatisfactory to the cultivator. The Dent sorts are the best to grow for green fodder and ensilage purposes.

Soil of Plots.—Good low land close to brook, kept fairly moist throughout the summer.

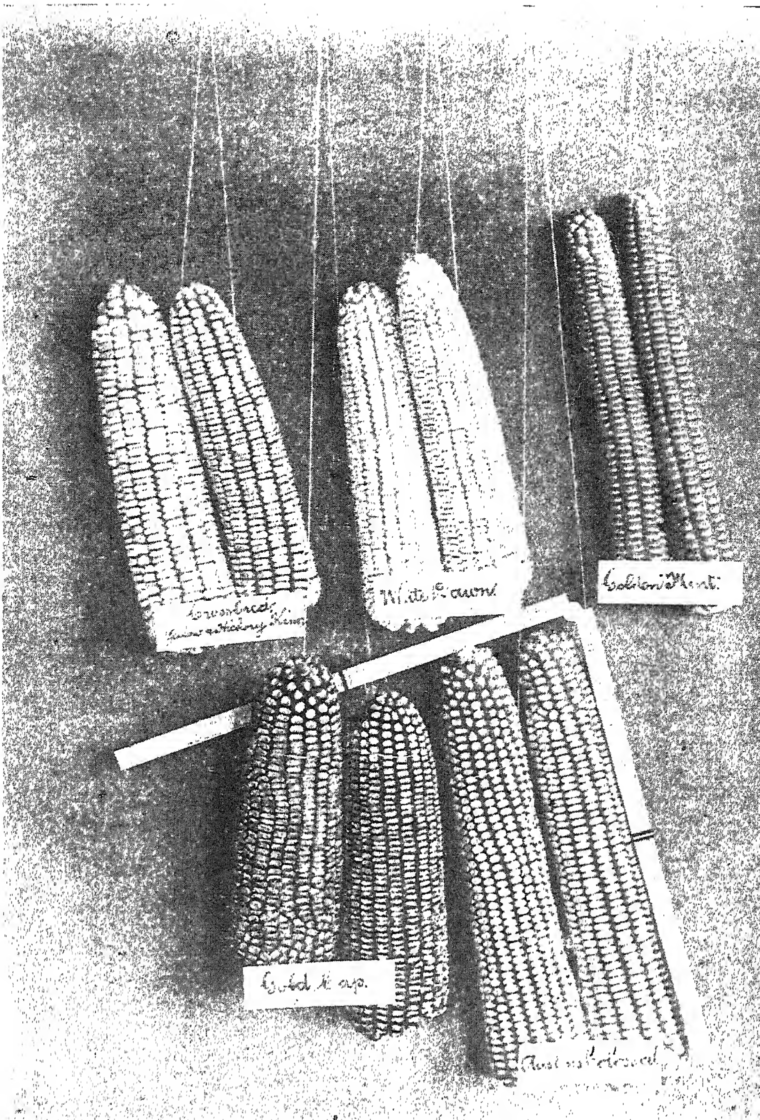
Culture.—Land worked deep; seed sown in rows four feet apart, plants every two feet along the drills. Fertiliser applied at the rate of four cwt. per acre when sowing the seed.

Gold Cap.—Local selection seed; sown 29th October; germination very even; growth healthy and vigorous; stalks strong, stand up well; height to 11 feet, fairly level; ripe end of March; ears nine inches long, one to two per stalk, thick and well-filled to tips with fine deep grains closely set in 24 rows; colours: base of kernel red with bright yellow dented cap, core red. Yield good, at the rate of 90 bushels per acre. To attain perfection this prolific variety requires rich soil and fair moisture during the whole summer. Plot grown on good land close to the brook.

Crossbred Yellow and White Hickory King.—Sown 30th October; germination even; growth healthy and fine; stands up fairly well; height to 10 feet; one to two ears per stalk, well filled; 10 inches long; 10 rows of wide and deep pale yellow kernels; core pink. Yield good, at the rate of 60 bushels per acre; ripe end of March; fair but rather late variety, requiring rich moist soil and long season to mature well. Plot of above variety sown on 10th December yielded at the rate of 33½ bushels per acre, or a decrease of 26½ bushels per acre owing to late sowing.

Yellow Hogan.—Sown 30th October; germination even; growth strong and healthy; stands up well; height to 10 feet; ripe end of March; ears large, 11 inches long, well filled; kernels dented, pale yellow, closely set in 18 rows; core white. Yield good, at the rate of 88 bushels per acre. Very good but late variety, requiring long season and good moist land.

Austin's Colossal.—Sown 31st October; germination good; growth fairly strong; stalks stand up nicely; height eight to nine feet; ears to 11 inches long, one to two per stalk; kernels bright yellow, deep, and dented, closely set in 18 rows; core pale red; ripe



Samples of Maize grown at the Experimental Plots, Hamel.

middle of March. Yield good, at the rate of 81 bushels per acre. Prolific main crop variety; requires good soil.

White Dawn.—Sown 31st October; germination good; growth healthy; stands up fairly well; height seven to eight feet; ripe first week in March; ears, two per stalk, eight to nine inches long, well filled, 14 rows of nice pure white dented kernels; good early variety. Yield at the rate of 60½ bushels to an acre. Plot sown on 4th December yielded at the rate of 43 bushels per acre.

Brazilian Flour.—Sown 31st October; germination even; growth very vigorous; plants stool out well from the base; prolific in green fodder, and one of the best to grow for ensilage or cornflour; height to 10 feet; ripe end of March; two ears per stalk, eight to ten inches in length, well filled; 14 rows; kernels pure white, smooth, soft, and floury; core white; good main crop variety; requires warm climate and rich soil to mature properly. Yield at the rate of 88 bushels per acre.

New Crossbred, Gold Cap and Brazilian Flour.—Sown 31st October; germination even; growth very strong, with fine broad foliage; plant does not produce many suckers; height to 10 feet; ripe end of March; two large ears per stalk, long and well filled; grain of various colours; type not yet fixed. Yield good; promising variety.

Golden Surprise.—Sown 4th December; germination good; growth fair, stalks rather weak; height to seven feet; ripe early, end of March; ears small, six to eight inches in length, not well filled; 16 rows; kernels dented, of a deep golden yellow; core red. Yield light, at the rate of 25½ bushels per acre; early variety, of weak habit; not desirable.

Golden Flint.—Sown late, 10th December; germination even; growth fair, not a tall growing variety; height five to six feet; ripe early, middle of March; ears, two per stalk, eight inches to one foot in length; eight rows closely filled, with smooth deep yellow grain of fair size; core white. Yield fair, 30½ bushels per acre; good, hardy, early variety for general culture.

Early Yellow.—Sown 4th December; germination good; growth not tall, but fairly even; five to six feet high; ripe early, last week in March; one ear per stalk, six to eight inches in length, stout and well filled; 14 rows; kernels dented; colour clear yellow; core white. Yield good, at the rate of 39½ bushels per acre. Fair early variety.

Red Hogan.—Sown 4th December; germination fairly even; growth tall and strong; height 10 feet, level and fine; ripe late, second week in May; one ear per stalk, nine inches in length, heavy and well filled; 16 rows; kernels dented, colour of a deep golden yellow, tinted red; core red. Yield at the rate of 43 bushels per acre. Late variety requires warm climate and rich soil.

Abercrombie.—Sown 4th December; germination fair; growth good; height, to 10 feet, fairly level; ripe second week in April; ears small, six to eight inches in length, badly filled; 16 rows; kernels pale yellow, dented, core white. Yield at the rate of 38 bushels per acre. Grain uneven in colour and type.

Cinquatina.—Sown 4th December; germination good; growth fair, not tall; average height five feet; ripe 1st April; ears two per stalk, small and uneven, four to seven inches in length; kernels small, smooth, pale yellow, and flinty; 18 rows; core white. Yield at the rate of 30 bushels per acre. Poor variety.

Hawkesbury Champion.—Sown 4th December; germination even; growth very vigorous and tall; height 10 feet, level and even; ripe late, second week in May; one ear per stalk, nine inches in length, 14 rows, well filled; kernels long, dented; colour bright yellow; core white. Yield good, at the rate of 87 bushels per acre. Late variety; requires warm climate and rich soil.

Cusco.--Seed imported from Peru; kernels very large and floury; colour pure white; sown 14th November; germination even; growth fairly vigorous; plant produces single stalks, rather slim and weak, liable to be laid by high winds; height to 11 feet; plants remained green until end of May. A few small ears set, but all failed to mature any grain. This variety is suitable for culture in tropical climate only.

PLEURO-PNEUMONIA CONTAGIOSA.

This is a diseased condition peculiar to cattle, which, owing to its highly infective nature, is most difficult to eradicate when once it becomes firmly established amongst a herd. It is more or less prevalent throughout Australia, but particularly in Queensland, where losses of a severe nature have occurred amongst travelling stock, this being the means by which the contagion is spread from place to place. The first known outbreak in this State was reported from the Canning Mills in 1897, when a team of working bullocks imported from South Australia were found to be infected, and since that period outbreaks of a more or less serious nature have taken place, and the past year has been no exception to the rule.

The period of incubation usually is from 20 to 40 days, but in some instances a considerably longer time may elapse before any marked symptoms are noticeable.

The disease first begins with an irritation of the small air passages within the lungs, and with the resultant inflammation and exudation of fibrous matter, ultimately closes the cells, which become impervious to the passage of air. This process continues until the lungs become a consolidated mass, and the pleuro also becoming involved, adhesion of the two surfaces of this membrane follows, with the result that the affected organ becomes firmly adhered to the chest wall. In some instances there is rapid destruction of tissue, and death results from suffocation probably within a week of the animal showing illness. The disease however is usually of a lingering nature, a considerable time elapsing before complete exhaustion takes place.

Some difficulty is experienced in detecting the disease in its early stages, and the affected organ may have undergone a considerable change before any suspicion is aroused that the animal is not in normal health.

An increase in temperature is usually the first sign, but this in itself is not a sufficient guarantee that the disease has been contracted, as instances have occurred where an animal has been affected without the thermometer denoting any appreciable change. It is, however, always safe when any suspicion exists regarding its presence to immediately isolate an animal showing an increase in temperature over $102\frac{1}{2}$. The most pronounced symptoms are loss of appetite, falling off in the milch supply, dullness, etc. As the disease advances, the breathing becomes disturbed and painful. This is particularly noticeable when pressure is brought to bear on the chest wall, or when the animal is made to move, then a distinct grunt or moan may be heard. A common position is for the animal to stand with the back arched, and the two hind legs brought well beneath the body. Should the affected animal be a cow in milch, almost complete cessation in the supply of this secretion takes place and a rapid falling off in condition is noticeable, also difficulty to move about is apparent.

As the disease cannot originate spontaneously, and, therefore, must be introduced, every care should be taken with fresh importations by keeping them separate from others until the owner is assured that the animals are perfectly healthy. In the event of the disease making its appearance amongst a herd, the affected animals should be immediately removed and destroyed, and with the virus which can be obtained from the lungs of an animal in the early stage of disease, the remainder of the herd can be inoculated.

THE CATTLE INDUSTRY IN AUSTRALIA.

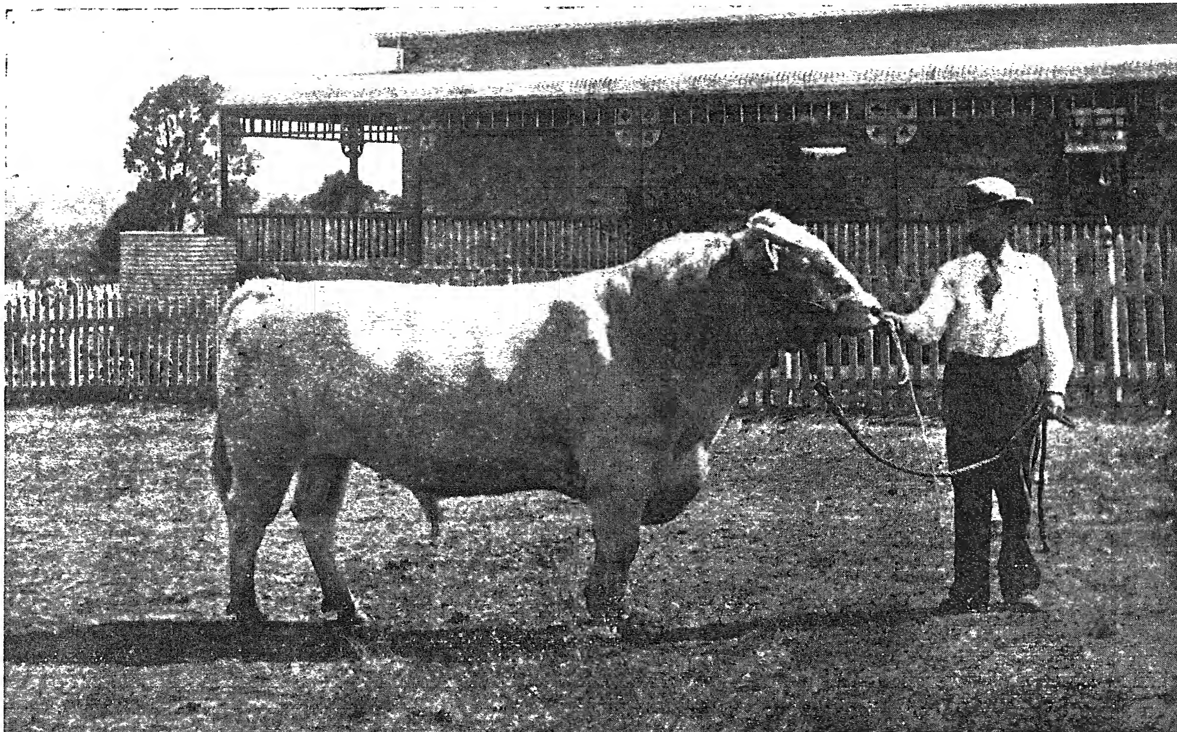
By W. G. McKINNEY, Melbourne (Vict.), Live Stock and Agricultural Contributor to the *Australasian*, *Argus* (Melbourne), *Town and Country Journal* (Sydney), and *Chronicle* (Adelaide).

GENERAL.

Wool production has represented the lion's share of Australia's rural wealth in the past, but the probabilities are that as time goes on horned cattle will become more and more important, and contribute more and more considerably to the income of the community, ultimately taking pride of place as a money maker on the farms and grazing holdings throughout Australia, and demanding increased respect and attention in proportion to the extent to which this class of animal proves its cash value; but it is worthy of note at the outset that cattle will never prove their cash value to the utmost unless systematic breeding and treatment be undertaken, combined with sound commercial methods in connection with the conversion of the various products of the cattle farm and dairy into money. It remains for the future to decide to what extent systematic production and sound business methods will be followed.

There is no part of Australia where cattle of all descriptions will not thrive; but, owing to the climatic conditions being variable in the different latitudes, it stands to reason that the character of all classes of live stock alters with altered circumstances. The remarks, however, that will apply to one State of the Commonwealth in respect to the general question of cattle breeding will apply with modifications to all of them; therefore, when it is stated that only a few of the many breeds of cattle known to breeding science have proved satisfactory in an all-round sense in Victoria, the statement may be taken as having application to Western Australia and the other portions of the continent. Furthermore, condemnatory remarks in regard to certain breeds that may be offered in the course of the present article will also have general application, and may be noted accordingly.

It is a well-known fact that districts called upon to produce horned stock must be more richly grassed than those devoted to the production of sheep or horses, and this for the reason that cattle are not as close foragers as the other two kinds of animals, while the consumption of food per head by cattle is, in proportion to weight, the largest of all. On the other hand, it is worthy of note, certain kinds of cattle will thrive well where the other varieties of stock will either starve or do badly; they can eat coarser grass and live under much more rigorous conditions of climate than horseflesh, while certain classes of country, where herds of beef cattle could be raised with very little trouble, would be found utterly



Champion Shorthorn Bull, "Lendenow Duke of Derrimut II."—The property of A. W. Edgar, Esq.

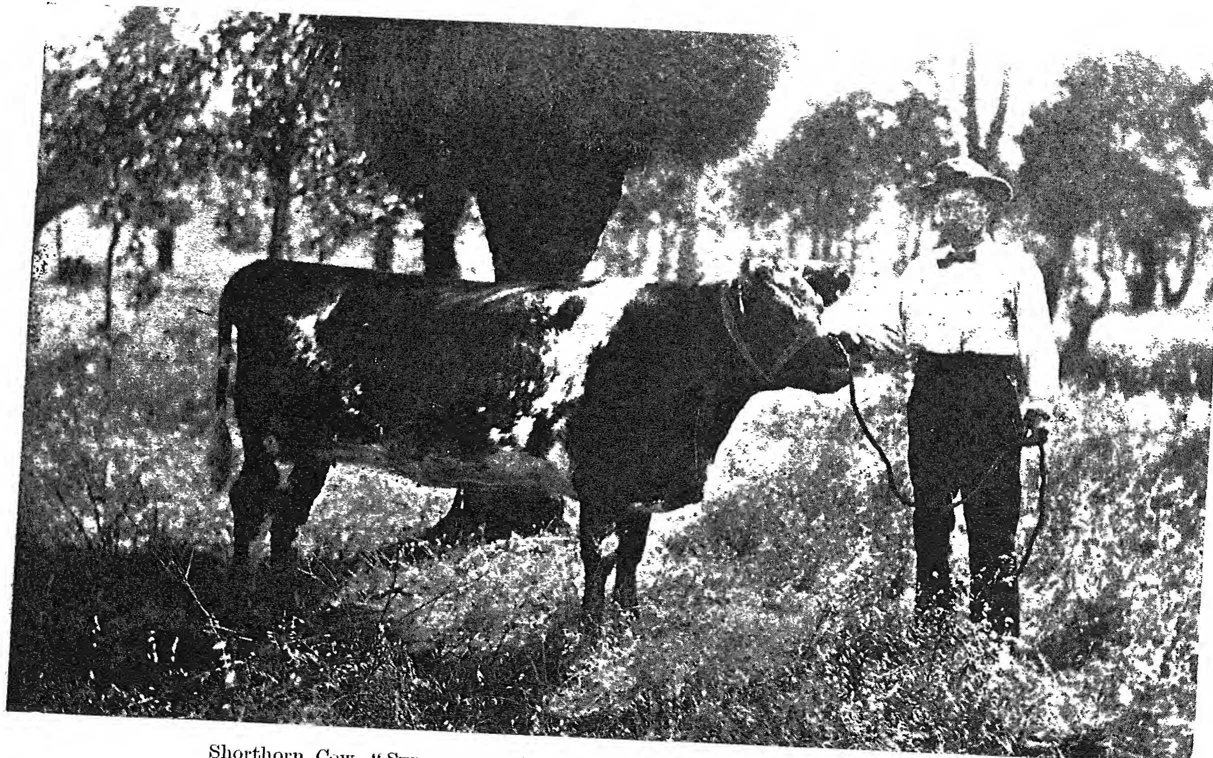
useless for sheep-growing, because the growth of herbage and undergrowth of shrubs, etc., would prevent the smaller animals, sheep, from getting about. The experience of cattle-breeding in Victoria in the past has been strongly in favour of Shorthorns for beef production, and Ayrshires and Jerseys for milk production. There is a section of the farming community which strongly advocates the Hereford breed of cattle for beef, and some of these people go so far as to pursue their advocacy of this breed to the extent of saying that they are profitable milkers as well. Controversy has waxed warm on all sides of this question, but without a doubt, the balance of opinion is in favour of the Shorthorns for beef, while there is a general consensus to the effect that the Hereford cows will never, either for crossing or for direct production, take their place alongside the two milking breeds mentioned, in the future dairying industry of Australia. The greatest perfection in cattle-breeding has been achieved in the history of Australia in respect to Shorthorns or the Ayrshires, and it is gratifying to note that the breeders of these kinds of cattle have not relaxed their energies or their enterprise in the matter of continuing the improvement of their dairy and beef herds. The annual sales of pure stock that take place in connection with the big agricultural shows in the big cities demonstrate the popularity of the two breeds mentioned, and the determination of those who are engaged in breeding operations to secure the best sires and dams that are possible and pay prices commensurate with the purity. This is the only sound policy in connection with cattle-breeding, as it is in respect to the production of all classes of domestic stock, and while applauding the enterprise of those who have, in their pure-breeding operations, followed the policy of securing the best specimens obtainable, it should be mentioned that their example is worthy of emulation by all stock-breeders, whether engaged in the work in a large or a small way, or whether they are raising pure or only ordinary herds. It is just as cheap to feed a well-bred animal as an ill-bred one; indeed, in many cases, it is much cheaper because one particular virtue of an animal with breeding is that it puts a greater proportion of the food it eats into milk or meat than a cross-bred, hungry creature, that demonstrates its poverty of blood by remaining in low condition under the best possible circumstances very often.

The study of breeding, then, should not be beneath the attention of anybody who essays to be the means of producing even one calf. "What is worth doing at all is worth doing well," and the man who raises a few calves, or a few hundred calves, is actuated by exactly the same motive, namely, the making of money, and being so prompted, it naturally should be his desire to raise that class of animal which will produce him the most profit. Even settlers who are far removed from pure-bred herds, where they can secure their supplies of breeding stock from time to time, should not neglect the study of strains of blood, and if it be that they cannot conveniently obtain exactly what they want in the way of pure or semi-pure varieties, it devolves upon them, as a duty to themselves, to look

around amongst their neighbours and do the best that circumstances will permit. At no time should they forget that the motto must be "Excelsior," so far as improvement is concerned, and that if they cannot get to the top of the hill in a purity sense, let them be satisfied to go as far as possible. The success in breeding of cattle does not depend entirely upon strains of blood, for they are but one factor in several in the great secret of success. General management, proper feeding, shelter where it is required, healthy surroundings, pure water, etc., are all essentials, and it is but the perfection of folly for a man to expend his money largely in obtaining pure sires and dams, or even moderately good specimens, of the breed he fancies unless he is prepared to "go the whole hog," so to speak, and assist nature as far as possible. Indeed very often the man with a fad for purity of strain, who pays little heed to the other necessaries, makes a more dramatic failure in the long run than the one who goes in for a complete policy of neglect, and this for the reason that highly bred animals are, with few exceptions, more delicate than the coarser bred ones, and they therefore suffer much more severely from neglect or scarcity of food and water than rough types of animals that have been bred from hardly treated parents, and have thus inherited the capability of withstanding hardships. It matters not whether a man has a fancy in the direction of beef or milk production, he must always keep before him the desirability of keeping his herd up to as high a standard as possible, and add to this particular class of wisdom a system of sound management. These are generalities that are worthy of consideration, and having briefly indicated a line of policy that will apply to all classes of cattle, we may now devote some attention to the particular breeds known in Australian rural affairs.

SHORTHORNS.

It is said by a noted English writer that "The reputation or value of the Shorthorn breed rests upon a foundation wider, therefore more ineradicable than that which upholds the credit of any other breed of cattle in the world. The Shorthorn is not the 'neat stock' of a party or a county, or even of a country. It has colonised the globe. It has taken root in Australia and the United States of America to such an extent that it is to be found there in numbers twice as great as are known to exist in Britain. Whilst a few hundreds of other breeds make—by the talk of their owners—a local reputation in a few centres wide apart, the Shorthorn exists quietly in thousands of herds, of whose rise and progress few have taken note, because, though kept pure, the produce has gone into consumption as beef and dairy cattle without any talk of pedigree. It is impossible," he continues, "that the Shorthorn can long go out of fashion," and he points out that this is due to the fact that so many people are interested in keeping up its reputation, also to the fact that the intrinsic excellencies of the breed are so clearly defined. These people in England and America are constantly vieing with each other for the improvement of the breeds, and it



Shorthorn Cow, "STRATHALBYN'S GIFT."—The property of A. W. Edgar, Esq.

was stated a few years ago in the American Shorthorn Herd Book that the increase of registered Shorthorns in the country names was at the rate of 15,000 a year. The activity in England has also been very great for many years past, and many wealthy men there have devoted their lives and their fortunes to the development of the desirable traits in the character of the animal they had under treatment. Indeed, the names of noted breeders in both America and England are legion, and it is gratifying to note that representatives of the herds from the most famous of these breeders have for many years past, been finding their way to Australia. More in the way of importation from abroad, however, could be done, for it is only by a constant infusion of the blood of the highly finished strains from the other countries that we can make the headway in this department of life that we should. The Australian conditions are eminently adapted to the production of Shorthorns, and with a proper expenditure of money by the more wealthy of our Australian breeders, it is quite on the cards that a reputation second to no other country in the world could soon be built up here. The Shorthorn, perhaps, offers the best scope for the display of enterprise in the direction indicated in a country that is more adapted for beef breeding than for dairying, and it may be said that the bulk of the Australian territory is of this description.

The Milking Shorthorn.

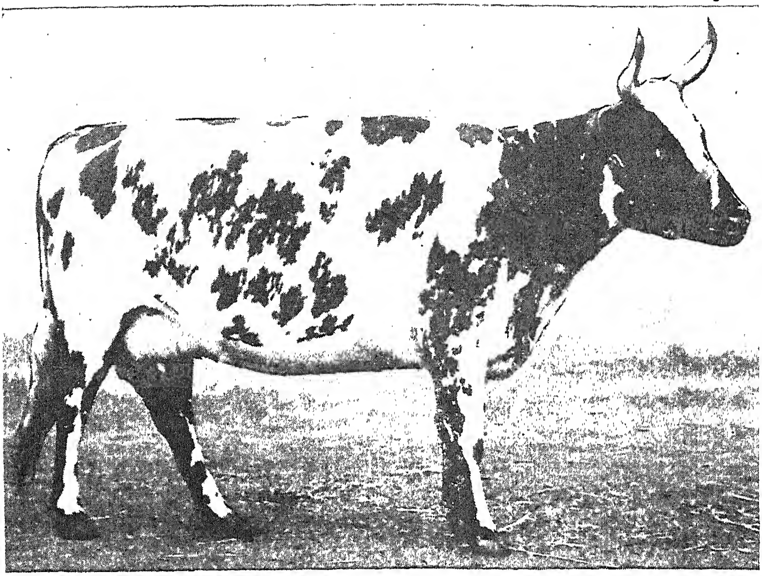
The most recent development in connection with this fine breed of cattle is in connection with its milking qualities. In earlier days, before the essentially milking breeds, such as the Ayrshires and the Jerseys, became recognised as the head of the herd in respect to the dairying industry, the Shorthorns were depended upon very largely for filling the milking pail. Later on, with the advent of the breeds mentioned, attention was given rather to the essentially beef characteristics possessed by the animal under notice, and the development for years was in the direction of building up the carcases for meat, and neglecting those particular portions of the frame that are associated with milk production ; but in comparatively recent years there has been introduced to the dairying world a strain of blood known as "the milking Shorthorn," and it is claimed by a good many noted breeders, more particularly by those who have been connected with the production of this strain of blood, that the development of the milking faculty, side by side with meat making, has made the animal doubly valuable in that it can be used for the beef or dairy farm at will ; but the contention on the other side is that the milking breed of Shorthorn is not sufficiently well established to make it safe to rely upon it to any very great extent as a milk producer, while others contend that no animal can be expected to reach perfection in the two directions, for the simple reason that the grass it eats must go to either one product or the other, for it manifestly cannot double its productiveness in the inside of the cow and produce a full measure of both commodities. It is argued, and with a con-

siderable show of reason, that when one strives to get two qualities in the one animal, both qualities suffer in value, and while the opponents of the milking Shorthorn are prepared to admit its good qualities in the dairy, which chiefly are derived from the excellence of its constitution, they contend that the essential milking breeds will never be displaced by any effort made to impart dairying qualities to the essentially meat producing breed; but there is another aspect to this question that is worthy of note, namely, that a dairy farm produces calves for slaughter as well as milk, and this argument points to the value of the milking Shorthorn strains in the dairy herd, because calves with this class of blood in their veins will develop into very good veal, and sell well, thus defraying some share of the expenses of the farm, while the progeny of the Ayrshires and Jerseys are entirely unsatisfactory, being smaller in body and inclined to thinness, two characteristics that are undesirable from the butcher's point of view. It would appear, on considering all the points of the controversy, then, that the milking Shorthorn, notwithstanding all that can be said against it, as a smaller milk producer than the other strains, has much in its favour. It has been demonstrated that specially bred specimens of this breed can produce immense flows of milk of excellent butter quality, the fact that Shorthorn cows have won the first prizes in the dairy cow classes at a large number of the best shows in Australia being sufficient to prove that in a milking sense they are by no means to be despised. The other fact that the calves are more valuable, combined with the additional virtue of beefiness possessed by the cows when they have become too old for the dairy and should be turned into beef, seems to supply quite a volume of evidence in favour of this branch of the family made the subject of these comments. Be the practical and scientific arguments what they may, it cannot be gainsaid that since the class described as milking Shorthorns were first introduced to Australia under that particular title, they have made steady headway in popular esteem and now must be reckoned with as distinct rivals of the recognised milk producing strains.

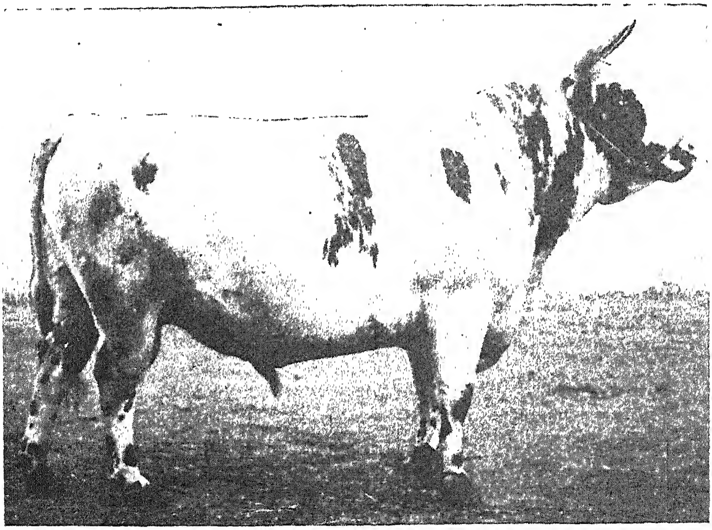
The two illustrations of Shorthorns are the property of A. W. Edgar, Esq., and have taken the following prizes:—

SHORTHORN BULL, "LENDENOW DUKE OF DERRIMUT II."

First prize, Guildford	1901
First and champion prizes, Geraldton	1902
First prize, Northam	1902
Do. York	1902
First and champion prizes, Guildford	1902
First prize, Bunbury	1902
Do. Bridgetown	1902
Do. and special, Northam	1903
Do. and champion, Guildford	1903



Ayrshire Cow, "JULIA 1ST."—Bred by Mr. James Gemmell, New Zealand.



Ayrshire Bull, "PEVERILL."—Bred by Mr. John Grant, Seafield, Tullamarine, Victoria.

SHORTHORN COW, "STRATHALBYN'S GIFT."

(No. 19 on cheek).

First prize,	Guildford	... ...	1901, under one year.
Do.	do.	... ...	1901, under two years.
Do.	do.	... ...	1901, best W.A. bred.
Do.	Geraldton	... ...	1902, under two years.
Do.	Northam	... ...	1902, under two years.
Do.	Guildford	... ...	1903, under three years.

AYRSHIRES.

Chief in order of merit amongst the dairying breeds is the neat little Ayrshire. Her reputation is so well known by this time in all districts where dairying has been followed that it is quite unnecessary to waste words in extolling her virtues. As to the origin of this breed there has been considerable controversy for many years, the opinion of some writers being that she is the result of a cross between the Shorthorn and the Jersey, while others assert that the breed has been derived from a careful selection of the native breeds of that particular portion of Scotland where she comes from. Be the facts what they may, it matters not; the Ayrshire is by now a thoroughly established class of animal and her reputation as a milk producer is undoubted. The Ayrshire one hundred years ago possessed many characteristics unknown to the best specimens of the class to-day, being small, hardy animals, irregular in shape, and altogether lacking in that attractiveness which to-day makes them the favourite in whatever show yard they appear, their beauty being such as to command the attention of even those show visitors who have no knowledge whatever of the points of horned cattle.

POINTS OF AN AYRSHIRE COW.

The points of the present day Ayrshire cow may be briefly set forth here:—The head should be small, long and narrow at the muzzle; the eyes small, sharp and lively; the horns small, clear, crooked, and their roots at considerable distance from each other; neck long and slender, tapering towards the head with no loose skin below. Shoulders thin, forequarters light; hindquarters large, back straight, broad behind, the joints rather loose and open, carcase deep, and wide over the hips, with round fleshy buttocks; tail long and small; legs small and short, with firm joints, udder capacious, broad and square, stretching forward and neither fleshy, low hung, nor loose. The udder is a good guide in judging the milking qualities of a cow. It should in form be long from front to back, stretching well forward on the belly, broad behind, filling up well the space between the legs, but should not be too deep vertically—that is, hang too far down. The milk veins large and prominent; teats short, all pointing outwards and at considerable distance from each other, skin thin and loose, hair soft and woolly, and the general figure compact and well formed.

The following are the points of the Ayrshire cow and their values in judging in the show ring. The points of the bull only

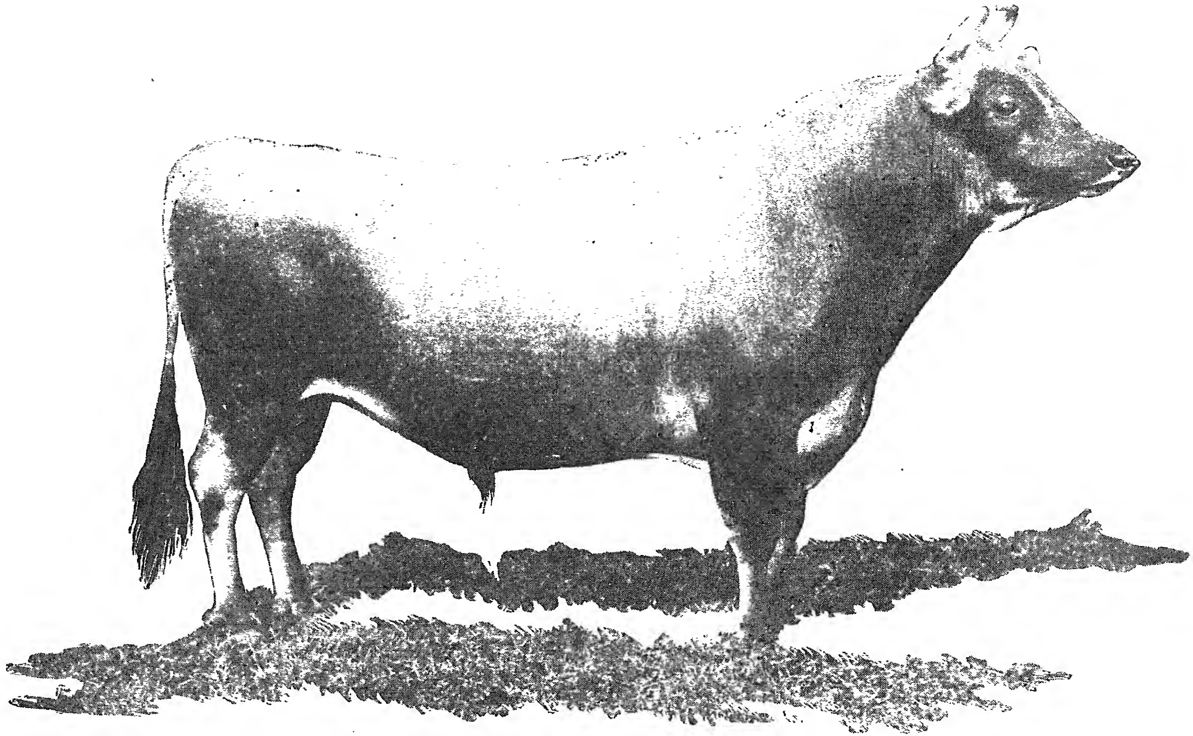
vary in the matter of masculine characters, which, according to the general rule, ought to be distinctly defined:—

		Points.
1.	*Head* short; forehead wide; nose fine between the muzzle and eyes; muzzle large; eyes full and lively; horns wide-set on, inclining upwards	10
2.	*Neck* moderately long, and straight from the head to the top of the shoulder, free from loose skin, on the under side fine at its junction with the head and enlarging symetrically towards the shoulders	5
3.	*Forequarters*—shoulders sloping, chest sufficiently broad and deep to ensure constitution; brisket and whole forequarters light: the cow gradually increasing in depth and width backwards	5
4.	*Back* short and straight; spine well defined, especially at the shoulders; ribs short and arched; body deep at flanks	10
5.	*Hindquarters* long, broad, and straight; hook bones wide apart, and not overlaid with fat; thighs deep and broad (but thin of flesh on inner thigh or twist); tail long, slender, and set on level with the back	8
6.	*Udder* capacious, and not fleshy, hinder part broad (and rounded like the side of a cheese); the whole firmly attached to the body; the sole nearly level, and extending well forward; milk veins well developed; teats from 2 to 2½ inches long, equal in thickness, and hanging perpendicularly; distance apart at the sides, equal to one-third of the length of vessel, and across to about one-half of the breadth; small teats are now considered most objectionable, both in the market and the show ring	33
7.	*Legs* short in proportion to size; bones fine, and joints firm	3
8.	*Skin* soft and elastic, and covered with soft, close, woolly hair	5
9.	*Colour* red, of any shade, brown or white, or a mixture of these, each colour being distinctly defined; brindle or black and white is not in favour	3
10.	Average live *weight* in full milk, about 10½cwt.	8
11.	*General* stylish appearance and movements	10
	Perfection	100

The Ayrshire is essentially more of a milk producer than a beefer. The most valuable quality that a dairy cow can possess is that she yields much milk, and that of an oily or butyraceous nature.

IMPROVE YOUR COWS.

The *Australasian Farm and Home*, Melbourne, a monthly journal devoted chiefly to dairying, gives the following good advice under the heading "Improve your Cows":—"Having improved the pastures, the next best thing to do is to improve the cows. Fix a standard percentage of butter fat, and also standard yield of milk per day. Keep no cow that falls below your standard of either quality or quantity. In order to give the cow a show to increase her quantity, she must be properly fed. In a year or two, when you realise the benefit of having fixed a standard, you will then be inclined to raise that standard a little higher, and thus be more



Jersey Bull, "Progress III."—The property of A. Murray, Esq., South Australia.

severe in the culling out of inferior cows. When you have a man by the day or by the week at so much and his keep, you look out that your man is earning what he is costing you in wages and keep, and returning you profit on his labour as well. Apply the same principle to your cows, and the duffers will soon have to go. A good shearer, a good harvest hand, a good ploughman, and so on, is known by his skill and earning power, and sought for by employers accordingly. So it should be with the dairy cows. Each one represents a certain earning power. Those that fall below your standard, get rid of. Those that are above the standard, treat them well, and they will repay you many times over for any extra expense in feeding and kindness."

General Particulars.

The general average for a milking season ranges from 560 to 750 gallons, there having been several instances where as much as 1,000 gallons have been produced by an exceptionally good cow. An interesting record is set forth in a sketch journal of a young Ayrshire cow having given nine gallons of milk daily for six months after calving, the gross value of the product at 6d. per gallon having thus been about £40. The cow was later on sold to an American breeder, and all her female progeny proved to be excellent milkers. Being good foragers and of hardy constitution, they enjoy a gratifying immunity from disease, and are reliable breeders. They are of active habits, and the bulls sometimes are inclined to be spiteful with one another and dangerous. It is estimated that three Ayrshires will eat about as much food as two ordinary Shorthorns, and that two good Ayrshire cows will give as much milk as three Shorthorns. The smallness of the globules of the milk makes the commodity specially valuable to the cheesemaker, the characteristics in this respect being in marked contrast with those of the milk from Jersey cows, the globules of which are large and more adapted for buttermaking. Some of the best strains of this breed in the world have already been introduced to Australia, more particularly in the districts where the Scotch people have settled, they having probably learned before leaving the old country of the habits and suitableness of this class of animal, with the result that early importations were made by those who could afford the expense.

Jerseys.

This class of cattle came into prominence in England in the sixties, and they met the storm of adverse criticism that is very often turned upon new things, the small-sized and pretty animals being described as "ladies' pets" and "toy cows." That their milk was rich in quality was freely granted, and it was allowed that a few in a dairy herd might be of advantage to impart a creamy colour to the milk. For many years, and right up to the present time, these critics have been unbending in their hostility and confirmed in their belief that the Jersey is too small to meet the utilitarian requirements of the time, and much that is said on the point is true, for where there is a shortage of beef there is a short-

age of profit. Yet, notwithstanding their smallness and the fact that their volume of milk is necessarily curtailed by the restrictions of their bag space, the breed has become amazingly popular wherever dairying has been done, for the richness of their milk is undoubted, while it is also a fact that by judicious crossing with Shorthorns, Ayrshires, and Herefords some excellent results in the way of heavy producers of creamy milk have been achieved. Besides this, the Jersey strain in an ordinary dairy herd lends it a beauty derived from symmetrical outline, and this is by no means an unimportant phase of the question, for practical and all as the farmers are and must be, they must not deny themselves the enjoyment of that which pleases the eye, nor will buyers at the farm quite overlook appearance, however keen they may be on "the dollars."

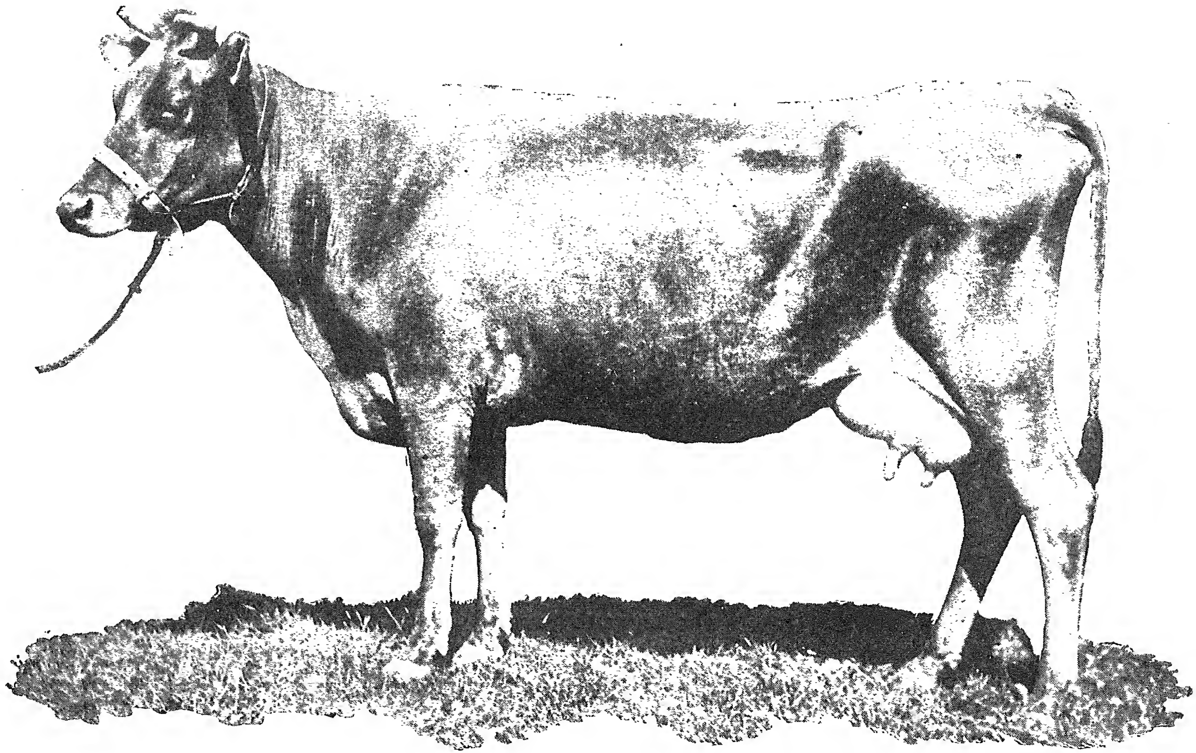
HOLSTEINS.

Regarding the Holstein or Frisian cattle, it is worthy of remark in passing that they, though comparatively little known in the principal dairying districts, are gradually forging ahead in places where they have "got a look in." A prominent American says he prefers them for the dairy because they are handy and as gentle as Jerseys, while their yields are heavy. Their beef is also abundant and good. Mr. F. Peppin was the first to bring them to Victoria, having made a large purchase of these cattle imported direct from the Netherlands into New Zealand by Mr. J. C. N. Grigg, who wrote as follows in regard to his selection:—"In order to get the Dutch Frisian cattle as pure as possible, I went to the very north of North-East Holland, in the country around Leenwarden and Groningen. I bought the bull Taureau at the Hamburg International Live Stock Exhibition. He was only commended at the show, but I preferred him because of his robustness, which showed that he had not been pampered in the least. I could have had the first prize animal at the same money, but he was simply a ball of fat."

Mr. David Mitchell, of Lillydale, and other Victorian farmers, favour the breed largely, and a number of important milking cow prizes have been won by competitors of this class at the best shows.

VARIOUS BREEDS.

In addition to the breeds of cattle mentioned above—Shorthorns, Herefords, and Jerseys—there are various other kinds known to breeding science, but may be special lengthy reference to them will not be called for in this article. These are Aberdeen-Angus, Devons, Dutch Cattle, Galloways, Guernseys, Kerry, Red Polled, Sussex, Swiss, Welsh, and as yet unnamed crosses derived from the mating of the several breeds in judicious fashion. These cross-breeds may some day become established as distinct breeds; this, at least, is the aim of the persons engaged in the delicate and studious task of mating. Most of the kinds named above have been introduced to Australia, but the bulk of them have yet their way to make in popular favour.



Jersey Cow, "Lady Lynott."—The Property of A. Murray, Esq., South Australia.

A TASMANIAN FRUIT SHOW.

By SYDNEYITE.

We have recently had in Hobart a fine show. The show was got up by the Council of Agriculture, and was a great success. Its principal attraction to those outside the growers themselves were the fine trophies of fruit prepared by the fruit boards. Of these there were eight, the first prize being awarded to the Ranelagh and Franklin fruit boards, for one 16 feet high, 12 feet wide, and holding about 80 bushel cases of fruit; reckoning 150 apples to the case, this makes 12,000 apples on the trophy. When lit up with electric light it looked very fine. A less impressive, but perhaps more artistically got-up trophy from New Norfolk took second prize.

Tasmania has gone ahead wonderfully with her fruit industry, largely owing to the demand in England and the Australian States for her fruits. To one acquainted with the conditions that prevail in both Tasmania and Western Australia, it seems wonderful that the latter State has not gone in more for fruit-growing; and instead of cutting extensively into the export trade, as she should do, not even growing enough for her own consumption. She can ripen her fruit before Tasmania, and is considerably nearer the London market, so that, reckoning these two together, she can place her fruit a good month earlier on the market, and with much less risk of deterioration on the voyage. This would be especially valuable to her with pears. That month would be worth many thousands of pounds annually to the Tasmanian growers, who have always to pick the fruit for the first shipments long before it is ripe. I have seen just as good apples grown about York, Northam, Bridgetown, Guildford, and Mount Barker as I have ever seen in Tsamania.

There were all sorts of apples shown—red, yellow, green, and purple apples, striped, spotted, and blotched apples, smooth and rough-skinned apples—ranging in size from the "cherry" apple, no larger than a cherry, to the monstrous "Prince Alfred," one of which weighed 2½lbs.

It was supposed that fully 300 different kinds of apples were shown; of these, of course many were of inferior sorts. In fact, of the commercial sorts there are probably not more than twenty grown in Tasmania, and of these again there are more of the following six sorts grown than all others put together, namely:—"Scarlet Nonpareil," "New York Pippin," "Sturmer Pippin," "French Crab," "Russet," and Golden Rennette." There are however, fair quantities grown of the true "Adams Pearmain" (down here called the "Dutch Mignonne"), "Alexander," "Snow

Lady" ("Femme de Niege"), "Jonathan" (this variety is rapidly coming into favour), "Hoover," "Crow's Egg," "Stone Pippin" (rapidly going out of favour through its great rival; the "French Crab"), "Royal Pearmain," and other sorts.

The "Scarlet Nonpariel" (commonly called here "Scarlet Pearmain" or simply Scarlet) is decidedly our best apple, being highly coloured and of a beautiful flavour; it also keeps well and travels well. Although our best dessert, apple it is a splendid cooker, and when baked is a dream of delight. It is a medium-sized apple. There are more trees set out of this than of any other kind, and yearly it is increasing in favour. It is, however, very liable to black spot in certain districts, and having a tender skin is easily damaged by spraying mixtures.

The "New York" (or "Cleopatra") is another decided favourite; it is a rather long apple of a green colour, becoming a waxy yellow when ripe, and occasionally with a slight flush. It is rather below the average size. It keeps and travels well. Like the "Scarlet," it is especially subject to attack by black spot, but stands spraying with Bordeaux mixture (the almost universal spray for this disease) better. It is also very liable to bitter pit, a troublesome disease which sometimes causes the fruit when opened in London to appear a mass of brown spots and seriously reduces it in value, the disease being especially troublesome to young trees and large fruits. Notwithstanding this, it is a splendid apple to grow, and yearly is being set out in increasing numbers.

The "Sturmer Pippin" is a hard apple, rather above medium size; it is of a greenish colour, with a rusty, red flush on one side. It travels better than any of the other commercial varieties and keeps better; in Hobart, being the last to disappear. Early in the season it is not of a particularly good flavour, but it improves greatly later on. It is an especial favourite with our larger growers on account of its keeping and travelling qualities, and many contend that it is our best paying apple.

The "French Crab" is a rather large, green apple, grown principally for the London market, where it is a great favourite. It keeps and travels well. The trees grow very large and produce heavy crops in alternate seasons, but when planted out in blocks are liable to be shy bearers, this being one of the kinds to which fertilisation of pollen is a prime necessity.

The "Golden Rennette" (usually here called the "Adams Pearmain," although a very different apple to that variety) is a showy apple, something like the "Scarlet" in appearance, but less finely flavoured. It keeps and travels well, and is a very desirable apple to grow.

The "Russet" is too old a favourite to need describing; it is one of our earliest apples, but many of the older people state that it is of inferior flavour to what it was when they were young.

Whether this is the case or not, it is now one of the best tasted apples we possess.

Over 100 kinds of pears were exhibited, but the show of these was inferior to what would be seen in New South Wales or Victoria, many of the Tasmanian growers having lost so heavily on their exported fruit that they are shy of going in largely for pears, and except for the stuff that had been kept in cool storage, the show was too late for the earlier sorts. There were also no especially large varieties of pears shown, and but few are grown in Tasmania. Certain varieties, however, such as the Bergamottes ond Beurres are grown to perfection.

One thing hoped for from the show, was that some stability would be arrived at with regard to names; experts attended from New South Wales, Victoria, and South Australia; and there were numbers of local experts, or so-called experts. By the time the show was over, dissatisfaction was expressed by many growers at some of the alterations made, and which will probably be ignored.

I saw Rex, of the *Mercury*, going round with a pear trying to get its name; he had seven or eight names for it then, and it was amusing to hear the scornful laugh each expert (nearly every grower here reckons himself an expert) would give on hearing the other names and the confidence with which he named it himself.

One grower showed me an apple which he called his "Turnip" seedling. It was a fine, showy apple, but with a coarse taste; if anything, inferior to that of a raw turnip. He told me he never sent it to the same agent two years in succession. Still colour will sell an apple almost as readily as flavour.

Some of the fruits shown were marked with bitter pit and black spot, but, as a rule, exhibitors were careful to hide all such defects. There appeared, however, to be a complete absence of grubby apples, showing how thoroughly the fact has been driven into growers' minds that it does not do to show such fruit. The Chief Inspector under the Codlin Moth Acts was seen closely examining the fruit, and had he found any of it grubby, it is certain that the exhibitors would have been prosecuted.

Altogether, some 2,000 bushel cases of fruit were shown, principally apples and pears. Some farm and dairy produce was shown, but not a large quantity, the southern portion of Tasmania being devoted almost solely to fruit growing.

An interesting exhibit was that by the Cool Storage Company, which showed some apples and pears that had been kept at a temperature of 33° for two months; the fruit was apparently in the same condition as when it was put in, and must have caused heart-burning to some growers who had lost heavily through fruit being damaged in transit to London.

There was a scramble of apples given by L. M. Shoobridge (our largest grower) to some State School children who attended, and it was amusing to watch the eager rush of the boys at the fruit

and the no less eager, but more staid way of the girls, many of whom, however, young as they were, had knights to get the fruit for them. Over 20 cases of fruit were scrambled, and the bearers had hard work to fight there way along.

Among the side shows were some models (decidedly inferior) of fruit from the Victorian Department of Agriculture; some named varieties from the New South Wales and South Australian Departments; some 30 or 40 cases of pests, shown by the Government Entomologist, and evidently demonstrating that orchardists don't have all there own way. Some home-made bread, cheese, and butter that, at the end of the show, was half dirt; home-made jams and preserves; agricultural implements, etc.

ONION GROWING.

(Written Expressly for the Journal.)

Though there are several kinds of onions grown in various parts of the world, there are only two classes that are seriously regarded by the best producers and the trade in Victoria, namely, the Globe and the Brown Spanish. These have possession of the markets all the year round, the one beginning to ease off as the other comes forward, thus providing an almost continuous period of supply from the various districts devoted to this class of crop. To Mr. P. J. Doyle, a leading Melbourne trader in this produce, I am indebted for some instructive particulars concerning onions, also for the information that the habits of the plant are such that they will grow well in all the States of the Commonwealth, and in any district presenting the character of soil and climate it requires. It is of an impressionable nature, if one may use the term in this connection; that is, it changes its appearance in different places to such an extent that the greatest difficulty is experienced by those inexpert in regard to the product to name the variety when seen in a new district. The Brown Spanish Onion is notable for its variations in this way. It grows long or short, broad or narrow, large or small, according to soil and climate, both of which exercise a distinct influence, the latter having such an effect upon the general appearance of the onion that it takes on different forms in the same district when the seasons happen to be dissimilar to each other. Thick and thin skins are produced by variations in climate, and the character in this respect is equally affected by ingredients in the soil, whether natural or artificially applied. Thus it becomes possible to bring about changes by attention to artificial fertilisers —assuming this theory to be correct—although there has not been,

so far, any dogmatic pronouncement on scientific authority on the subject of what class of chemical produces them, and what kind thick skins.

THE SPANISH ONION.

One trouble experienced in connection with the onion-growing industry is that a fall of rain or a spell of intense heat is likely to bring about the destruction of an entire crop by the skins being rotted or roasted off by either one of these conditions of weather. In this respect, however, the Spanish variety is not in as bad a position as the Globe, as it is more hardy. This fact gives it a value that is of importance in a climate such as that of Australia, where sudden and unexpected weather changes often take place, producing not only disaster in the onion fields, but in the cereal districts as well.

THE GLOBE ONION.

The fact that this variety comes in about December makes it peculiarly likely to be damaged during pulling time by intense heat, while the onions are on the ground awaiting removal. A shade heat at 104 to 105 degrees, or a sun heat of 160 degrees, is an intensity of temperature the crop cannot stand, and it causes no surprise to those acquainted with its susceptibility to climate influence when they hear of heavy losses in the fields at gathering time through a sudden change, either in the direction of wet or heat. The effects are very often so sudden that the most rapid removal does not save the skin from being peeled off, and in that condition the produce is unsaleable, as it will not keep, deprived as it is of its natural protection. The Victorian experience in regard to this variety is that it grows best in light sandy soil—a class of country that will not suit the other variety, its requirements being red, chocolate, or black soil, rich in character.

WORK ON THE ONION FARM.

Method must be adopted on the onion farm, not only in sowing, cultivating, harvesting, and protecting from the weather, but in selecting seed as well; indeed, this latter duty is one of the most important on the farm, but it is only done by the man who likes his work as an onion-grower. The one who takes this crop "in his stride" and does it casually, mixed up with other branches of agriculture, operates in half-hearted fashion, and grows inferior onions, and these do not yield enough cash to pay for the bags, let alone pulling and carting, and rail-freight and commission. Good onions are worth growing; bad ones never are.

The way the best Victorian onion men improve their "breeds" is to store aside on shelves selected onions of best shapes, and sound in quality. Let them lie there till some of them decay, and while some of them remain sound. The sound ones are the best, and the only ones worth reproducing from. Plant these out in July and August, and the seed is ripe by January, ready for the May sowing.

Do this year after year, and the results are sure. In this way one grower, who does not want his name mentioned because, he says, he has no liking for notoriety, has made a big reputation in onion culture, and is on the track that leads to fortune. He has a crop of 1,200 tons of prime brown Spanish at present in his sheds.

Ground can be ploughed shallow when new, say three inches deep. As it grows weaker by cropping, the new soil below the three inch level can be turned up in after-seasons, say two or three inches at a time, right down to 12 inches if the soil be deep enough, and it should be deep for this kind of crop.

Fertilising can be done with the seed-drill, but not at sowing time. This work is best done by itself, before the seed goes in. There are many good machines for this purpose on the market.

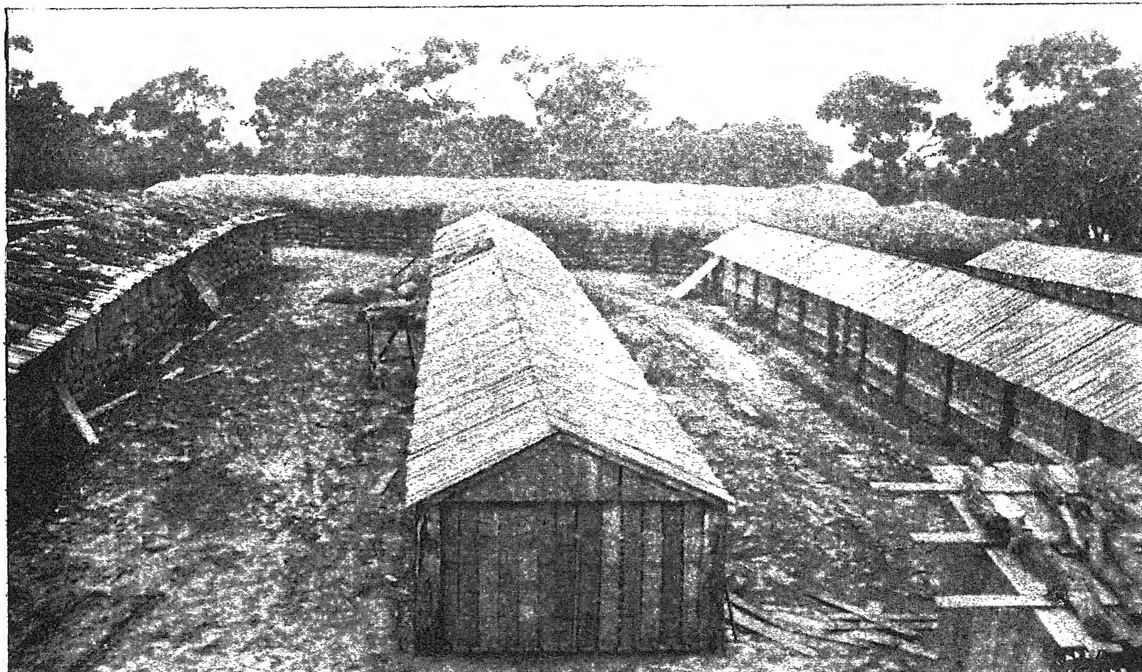
Drill in the seed in rows two feet three inches apart, after working the ground to a fine tilth with harrows, and roller where necessary. From 3½ to 4lbs. of seed per acre should be used at the beginning of the season, commencing in May, and tapering off to 2½lbs. per acre as the sowing time advances, finishing in August, or as late as October in exceptional seasons. The late sown crop will almost overtake the early, because the ground is in better heart when the weather is warmer, and, besides this, the seed nearly all germinates when sown late; that is why a smaller seeding will suffice.

Thinning out is done in September or October, by which time the plants may be five inches high. Weeding with a hand-worked Dutch hoe must be commenced as soon as the young plants are sufficiently well forward to allow this work to be done, and it should continue right along to the end of the year. Pulling starts about February. In a favourable season a good man can keep five acres clear of weeds.

The ground becomes onion-tired after a few years. When this takes place, spell it by putting in a crop of pease, barley, potatoes, or whatever other kind suggests itself as suitable to the land or the owner's requirements.

Large onions are not favoured by buyers, therefore the aim should be to grow those of medium size. They have better flavour, and are, as a rule, sounder than the over-sized ones. The medium kind export better, and the yields per acre are likely to be as good as where the aim is to raise them as big as pumpkins, or thereabouts.

Being liable to injury by rain or sun, a properly-equipped farm has plenty of shedroom near to the crop paddock. These can be cheaply constructed of split palings, long and low in design, with the side palings an inch or so apart to provide ventilation and keep the produce from sweating. The roof palings must be laid water-tight. A photographic reproduction of the sheds on a farm in Victoria is published herewith. It will afford some idea of the



Onion sheds on farm in Gippsland (Vic.).
The onions are carted here after gathering, bagged for market, and stored until taken away.

[Photo by Harvey & Sutcliffe.]

method of building these places, as well as of the extent of the operations in progress.

The following particulars of the work done and methods adopted on an onion farm have been kindly supplied to me by one of the largest producers of this commodity in Australia, a gentleman of wide practical experience, who has given more than the usual amount of study to the question of improving varieties:—

"The growth of onions has assumed considerable magnitude in the State of Victoria, and it will interest those who may engage in onion culture in other States to learn the methods which have been adopted successfully here. It is of importance, in the first instance, that a deep, rich, strong soil should be selected, one which does not suffer from surplus or stagnant water. It should be ploughed a month or two before the seed is sown, to enable the soil to sweeten and mellow, so that a good seed-bed may be formed. After ploughing, the frequent use of the ordinary harrow and roller is generally adapted here in the preparation of the land. All stones, roots, or rubbish should be removed, otherwise the operation of drilling cannot be successfully carried out.

"The seed is sown with a cup-drill covering two rows, with a distance of from nine to 12 inches between each drill, and from 2lbs. to 3lbs. of seed per acre is the quantity generally used, the colters being adjustable to the distance desired. The drills are chiefly manufactured at Drysdale and Bellarine, which are the first districts where onions were cultivated to any extent. The variety generally grown is the improved Brown Spanish, selected on account of its keeping qualities and suitability for export. The seed is largely grown in the Drysdale and Portarlington districts.

"The sowing takes place from May to July, and the seed usually makes its appearance in rows, easily traceable in about a month. The Dutch or shoving-hoe is invariably used, and the width selected for this tool is some two inches less than the width between the rows. The operation of hoeing must be performed as soon as the rows can be traced, and repeated two or three times as may be necessary. Hand-weeding should be done as soon as the weeds are large enough to enable the weeder to take hold of them. Successful growers hoe frequently, and keep the crop scrupulously clean of all weeds. The onions should be thinned out when about the size of a pencil-case, and should be at least three inches apart.

"When the onions have attained their full growth, which is usually about seven months after the seed is sown, or during the months of January and February, they are harvested on the ground in rows collected in that way by wooden rakes, which follow a skim-plough especially made for that purpose and covering about three feet at each stroke, thus cutting from the ground three rows at once. They are permitted to remain in these rows from two to four weeks, according to the weather, and are then picked up into bags and conveyed to sheds or stores, or stacked in convenient heaps about seven or eight bags in height, the stacks being about

nine or 10 feet wide, and usually covered with straw or other suitable covering. The onions must be thoroughly dry before storing.

"Care must be taken in preparing the onions for market, and any bruised or decayed onions must be set aside. They are sent to market in bags, but some of the larger and more settled growers have packing sheds, in which they are packed in cases made to hold about 1cwt. each.

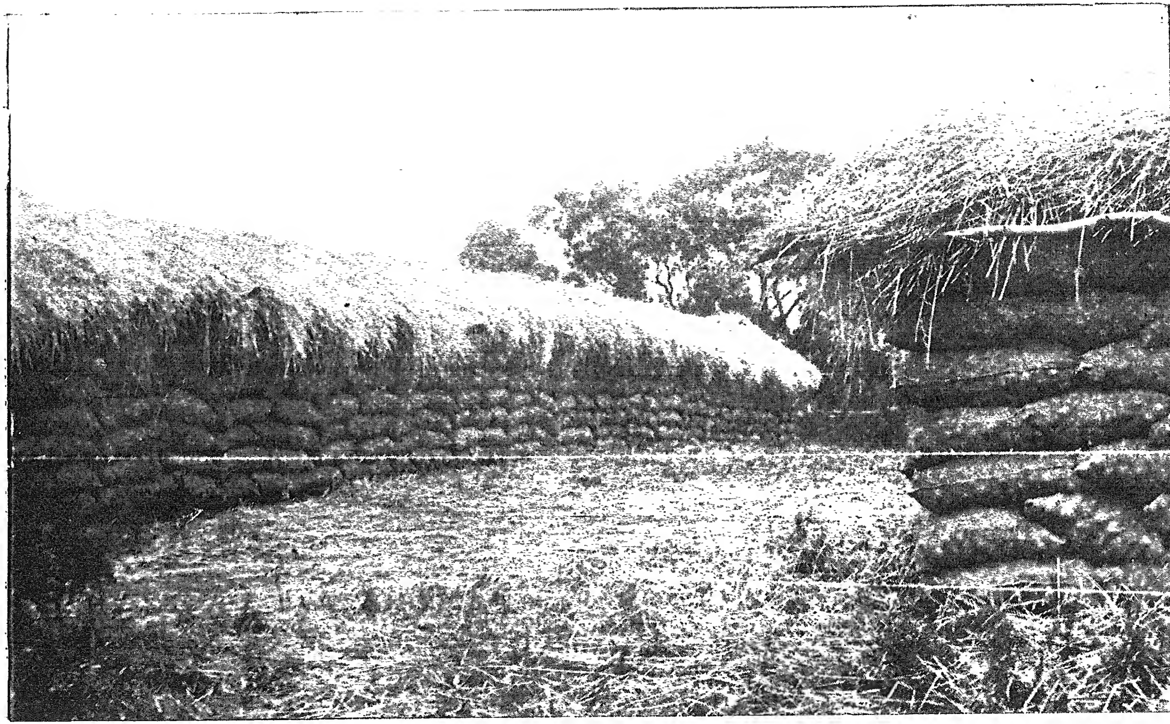
"Considerable quantities of onions are grown by market gardeners in the vicinity of Melbourne upon the sandy soils, but the variety cultivated there is the early Brown Globe, which has not the keeping qualities of the improved Brown Spanish. A different method of cultivation is, however, adopted. The seed is sown in seed-beds during February and March, and is watered to ensure its growth in time to produce a strong plant for transplanting. That work is generally performed about July or August, in drills 11 inches apart and six inches from plant to plant. Frequent hoeing and cultivation are necessary, as in the case of the field onion. The harvesting of the early onion is performed by pulling with the hand or hoe, but little time is allowed on the ground for the onion to dry. The general rule is to cut the top off and send to early market in bags or cases."

POULTRY NOTES.

By F. H. ROBERTSON.

HOW TO FIGHT THE TICK PEST.

Fresh Regulations have recently been issued by the Stock Department dealing with Poultry Tick, but to succeed in eradication, it is necessary that the habits and life history of the pest should be generally known. In the first place I may say that the tick is a larger insect than most people suppose, a well-developed specimen being a quarter of an inch in length, and of somewhat similar appearance to the ordinary house bug, which it also resembles in its habits, being nocturnal, remaining in hiding in the woodwork during the day time, and coming out at night to feed on the fowls, have their fill of blood and retire; and, therefore, anyone suspecting their fowls to be affected by tick need not go to the trouble of catching their fowls to examine them, but should make a thorough examination of the wood-work of the fowl-house, particularly in the vicinity of the perches; take a hammer and chisel and open up all cracks and crevices, between boards, also wherever

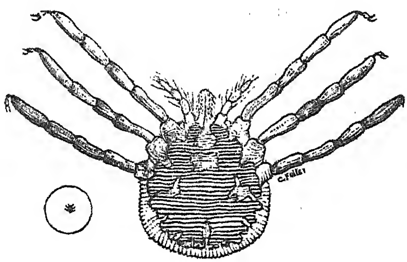


Stacks of bagged onions ready for market, covered with straw for protection from rain and sun.

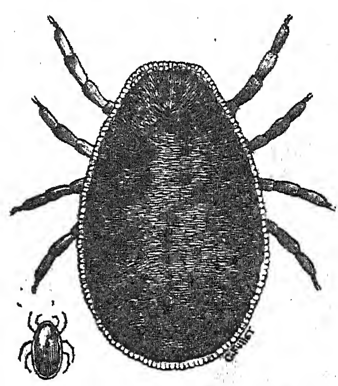
[Photo by Harvey & Sutcliffe.]

a space is left between two pieces of nailed timber; if there are any of the vermin about there, they may be found.

On my rounds of tick inspection I met so many people who are quite positive there is no tick on their premises, because they are frequently catching their fowls, making careful examinations, and dipping them, but they never find any tick on them. Such is quite likely to be the case, because tick only remain on fowls about a week; that is when they are just hatched (or in the embryo or larval state), as per illustration No. 1. They have their fill of blood, drop off the fowls, and retire to the crevices of the woodwork. In this stage they are a little lead-coloured insect, about twice the size of an ordinary pin-head, but slightly oval in shape, with six legs. I inclosed a nice little lot of nymph (or second stage) ticks in a pill box on 26th of last April, and on looking at them a month later found all alive, but most of them had done a complete moult, having cast off everything, including the shells of their three pairs of legs, and they had also grown an additional pair of legs, now making the full compliment of eight legs, which is the adult stage, as per illustration No. 2. The remainder of the tick's existence is passed in seclusion; occasional feeds are indulged in at night time only. This trait of their character often misleads poultry-keepers, because on examining the fowl-house at night time no ticks are to be seen crawling about the walls or perches. They are most active during the summer months, but as the weather becomes cooler their visits to the fowls are less frequent. To a great extent they lie dormant, but if neglected. come out in greatly increased numbers the following season, The tick lays a large number of brownish-coloured eggs, which are found in crevices of the woodwork, and are easily discernable to the naked eye. They hatch in a month's time and emerge a little, colourless, long-legged insect, which is the larvæ, or first stage tick. They are not often to be found in this stage, because on being hatched they very soon fasten on to the fowls. In tick-



No. 1.—Young larvæ, greatly magnified, natural size within circle.



No. 2.—Adult Fowl Tick, greatly magnified, and natural size.

infected fowl-houses which have been vacated for, say, three months during the early summer, the larvæ tick are likely to be very numerous and voracious, and the unsuspecting incoming tenant who brings fresh fowls generally loses most of his birds owing to the wholesale attacks of large numbers of hungry tick of all stages. Anyone taking fowls to different quarters should be careful to first find out if there are tick about; if so, the fowls should be kept right away from the infected locality.

The Spread of Tick.

It is very surprising the rapidity with which the pest has spread over this State. Ten years ago it was almost unknown. It now behoves all poultry-keepers to exercise the greatest care in preventing its further spreading. One great disseminating agent has been from the almost universal custom of erecting the fowl-house at the end corner of the yard; for the sake of economy the existing fencing forms one side and the back, the consequence is that the tick crawls along the fences from one fowl-house to the other, until whole blocks become infected. The fencing is a particularly difficult matter to deal with, the ticks get behind the pickets, and into the posts where the rails are let in. All fowl-houses should be built as far away from fencing as possible.

Another source of dissemination is from fowls which are caught at night time, cooped up and sent away. It is always much safer in purchasing fowls to see that they are caught and sent away in daylight.

Care in Purchasing Poultry.

Great care should be exercised in purchasing poultry to ascertain that they come from yards or districts that are free of tick. Albany is at present quite full of tick, and probably the whole of the South-Western districts, such as Bunbury, Busselton, Bridgetown; but Northam, York, Newcastle, Beverley, and Geraldton are all infected. Perth and suburbs are also very bad. In introducing fresh blood into a yard, the safest plan is to procure eggs and hatch them; but if fowls are obtained from other places they should, before being introduced to a clean yard, be kept in quarantine for at least seven days in quarters quite away from the other fowls, and released by daylight; but before doing so make a careful examination of the perches of the quarantine premises to ascertain if the new arrivals brought the pest with them; if so, they will have dropped off the fowls and taken to the woodwork, which should be burnt or treated as directed.

Means of Eradication.

To get rid of tick is a tiresome matter if the houses are built of wood and against fencing. If the following directions are properly

carried out, as published by the Stock Department, the pest should soon be eradicated, viz. :—

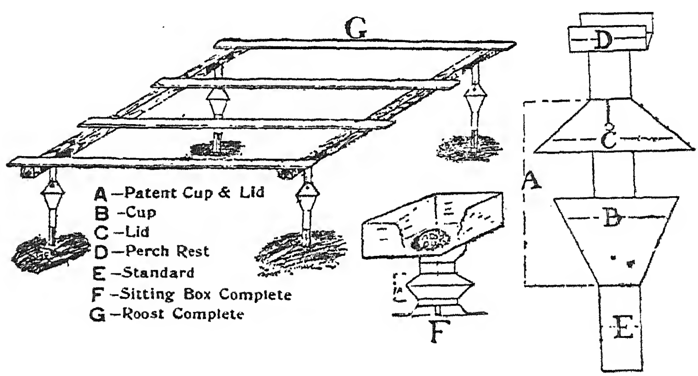
(*a*.) All fowl-houses and the appurtenances used in connection therewith shall be dismantled, and all visible ticks destroyed.

(*b*.) All material with which such fowl-houses and appurtenances are constructed shall then (if not destroyed by fire) be saturated with boiling water, and in order that all ticks and their germs hidden in crevices may be destroyed, thoroughly saturated with a three per cent. solution of carbolic acid and water.

(*c*.) Should the fowl-houses be in close proximity to or attached to fencing, such fencing must be treated in a similar manner.

(*d*.) The whole of the ground area of infected houses, etc., must be strewn to a thickness of half an inch with fresh quicklime, and then slaked with water, also the ground within three feet of each side of infected fencing must be treated in a similar manner.

Having carefully followed out the above directions, the next thing is to take all precautions against a fresh outbreak next year; as, should there be a few eggs or an odd tick or two which have escaped, the pest would make its appearance again.



"McCORMACK'S TICK PROOF PERCHES."

The new fowl-house should be built entirely of iron, with all wood-work outside, and quite away from all other buildings or fencing, and no perches should touch the walls of the house. The best plan is to use tick-proof perches; that is, perches which completely isolate the fowls whilst roosting at night time. There are several forms of such perches. One good plan is to suspend the perches by wires from the sides of the walls, running the wire through a soldered tin or inverted and corked neck of a bottle,

keeping same filled with water and kerosene. Another plan is to use down-piping in lengths of about $2\frac{1}{2}$ feet. Hammer, say, six inches into the ground, and on top of the piping affix the perches, but to prevent ticks crawling up a cup is soldered round the piping and kept filled with water and kerosene. But it would probably be found cheaper in most instances to use the patent perches illustrated here, and invented by Mr. McCormack, of Coolgardie, which are obtainable at the ironmongers' shops at a low figure. These shields which prevent the pest reaching the fowls also act as a trap, so that the premises may be more quickly cleared of the pest. If every fowl-house in the State were made entirely of iron, quite away from fencing and provided with tick-proof perches, the pest would as a natural consequence be starved out.

Tenacity of Ticks.

Ticks are wonderfully tenacious of life. I have kept them in a bottle for 12 months, and found that they laid eggs and hatched young ones, some of which live a long time. On the 27th February last I enclosed tick eggs in a pill-box, they all hatched in about three weeks' time, and now (9th June) several of the young larvæ tick are still alive.

Occasionally persons finding tick in their houses, burn them down and compel the fowls to roost in trees. but this plan frequently fails to get rid of the pest as I have found trees badly infected; even in the castor oil tree, which has very smooth bark, I have found ticks in dead limbs, which afforded hiding places for the pest.

Tick Destroyers.

Boiling water and a three per cent. solution of carbolic acid and water are reliable agents for killing tick, kerosene is also good, and tar is another very good tick destroyer especially when applied to fencing, but whatever is used it must be done thoroughly and got right into crevices and behind nailed timbers. The tick being a flat insect can secrete itself in very small spaces, hence the necessity of dismantling timber to get at it, but in some instances it is found impossible, or likely to entail too much expense, in dismantling substantial woodwork, in such cases tar will be found very serviceable, but it should be liberally supplied and run well into the crevices, completely stopping them up, if this is properly done the tick will be imprisoned and thus starved to death.

Symptoms of Tick.

Tick infected fowls present a miserable appearance, dull plumage, shrivelled comb, and great leg weakness, and die of exhaustion from tick fever, and loss of blood taken from them by the ticks at night time. Fowls which get over the first effects generally become immune to further attacks, and appear to thrive fairly well; but fowls which are subject to such a drain of blood cannot thrive satisfactorily; they have an anæmic look about them,

there is great difficulty in rearing chickens, and if fresh fowls are introduced they fare very badly. The pest is a most objectionable one, which has caused great losses in this State, and it is hoped that poultry keepers will take all means in their power to stamp it out.

The embryo tick, when fastened on to fowls, soon fill with blood, and become dark in colour. On turning back the feathers little black specks are noticeable about the size of a pin's head. To kill them in this stage, smear the ticks with lard or fat, to which has been added a little kerosene, but as already stated, it will generally be found preferable to quarantine fowls affected by embryo tick. Allow the insects to drop off and then burn or disinfect the box the birds had been quarantined in.

THE POTATO CROP.

(Written Expressly for the Journal.)

Different "breeds" of potatoes are adapted to different districts; a locality that will grow one or two kinds in abundance and of excellent quality will fail to give anything like fair results if any one of half-a-dozen other varieties are planted. This fact points to the necessity for studying character of soil before giving in one's adhesion to any particular class of potato. Again, there are some tubers that possess excellent keeping and carrying qualities, and are the only ones that should be grown where outside markets are going to be catered for; there are other sorts that keep and carry badly, and are only suitable for cultivation where local requirements are to be met. These points are emphasised by Mr. Doyle in the conversation referred to, and his life-long experience in the trade he is engaged in gives to his remarks an importance that commands attention.

This is the way he classes the several varieties that are grown in Victoria, and will grow equally well in any part of the continent where the necessary qualities of soil and climate prevail.

New Zealand Pink Eyes are the best potatoes that can be grown, provided the soil be not too rich, and they attain their best results in a season that is not over wet, for being of a vigorous nature, under hard conditions, they will overgrow themselves when too much nourishment is derived from the soil, or when the rainfall is so abundant as to over-stimulate them. An illustration of this is to be found in the crop at present to hand. There was abundant rain in the summer period, and where the ground was anyway rich the results in most instances were tubers so greatly overgrown

as to have become hollow in the middle. This potato has a very delicate skin, and is susceptible to the weather after being dug, a fact which fits it for home use rather than for export, for when kept for a considerable time its surface becomes green, and this is a fault in its appearance, apart from the unpleasant flavour associated with this change of character.

Red Skins are the best kind for export, being a good keeper. They require rich soil and more humid conditions of weather than will suffice for the Pink Eyes. Rich red or black soil suits this variety best. The returns from a Red Skin crop, year after year, are not as reliable as those from a Pink Eye plantation. Last year's Western District experience proved that very costly results may accrue from a comparatively unimportant climatic unsuitableness. The crops in many instances there were only equal to from $2\frac{1}{2}$ to $3\frac{1}{2}$ tons per acre, while in the same locality the Pink Eyes gave yields of from 12 to 20 tons, and the market prices for the latter were considerably higher than for the Red Skins, which were in many cases so poor in quality that they sold very badly.

Scotch Greys are very similar to the Red Skins, and they are regarded by many people as equal as a cropper, as well as in quality, to the latter. They require the same class of soil and climatic conditions, and where the one thrives well the other does also.

Other kinds in favour in Victoria for home consumption and export purposes are:—Beauty of Hebron, Russett, Excelsior, Vermont, Early Rose, Brownell Beauty, the first-named being the next best yielder to the Pink Eyes, the Russett and the Excelsior coming next.

HOW TO GROW POTATOES.

Potatoes make exhaustive demands on the soil, and require liberal supplies of manure. Farmyard manure is good, because the plant is a surface feeder and requires its nutriment in an easily available condition; but experiments favour the application of nitrogen to the soil in the form of nitrate of soda. Sulphate of ammonia is valuable in wet seasons in the absence of farmyard manure, but it loses its influence when the latter is also used. Phosphatic manures are best applied in the form of superphosphate. The proportion of nitrogenous manures used must be regulated by the quality and condition of the soil.

The right time to dig potatoes is, generally speaking, when the tubers loosen freely from the roots and are ripe enough to handle without "skinning" or being liable to bruise easily. When dug early they should be put in a dark place and kept cool and dry.

Two important points in growing potatoes is to have a mellow soil and a fine tilth. To secure the best results with all root crops, it is an important item to work the soil deep and thorough, and usually the more fully this is done the better will be the growth and yield of the crop. In nearly all cases the more fully the soil is prepared before the seed is planted the easier the work will be of

keeping in a proper condition afterwards. The harrow can nearly always be used to good advantage in a few days after planting the seed, and then once again as the plants show well above ground; this will aid materially in killing the weeds and keeping the soil fine and mellow. In using the cultivator the first time, care should be taken to work reasonably deep and as close to the plants as possible, and at each subsequent cultivation work a little shallower and a little further from the plants. After the plants make a good growth, care must be taken not to disturb the roots, and especially so after the tubers begin to form. It is often best to give a thorough cultivation when the plants are in bloom, taking pains to thoroughly stir the surface, and following with a hoe to kill out the weeds between the plants in a row. Keep the soil level; there is no advantage in hilling-up, and in a dry season it is a disadvantage, as the soil will dry out much more thoroughly than if left level, and this often seriously affects the growth and yield of the crops. Potatoes require considerable moisture to make the best growth and yield, and by keeping the surface level and in good tilth, you aid materially to retain moisture in the soil. Another advantage in keeping the soil level is that the cultivation can be repeated as often as may be considered necessary for the best growth and thrift of the crop, and when the soil is weedy this is often quite an item.

THE SWINE INDUSTRY IN AUSTRALIA.

By W. G. McKINNEY, Melbourne (Vict.), Live Stock and Agricultural Contributor to the *Australasian*, *Argus* (Melbourne), *Town and Country Journal* (Sydney), and *Chronicle* (Adelaide).

It has been jocularly remarked by someone that whenever he sees a pig he feels inclined to take off his hat to it to show his respect for his profit-producing qualities; and it has been philosophically said by another person that the pig is the "Gintleman who pays the rint." Both persons are pretty nearly right in their estimate of this class of farm stock; indeed, it may be said that they are absolutely right, for the pig is a money-maker who must necessarily command the respect of the economical producer, and he has the capacity of not only paying the rent but some of the household bills as well. In Australia, however, pig-raising has not in the past been accorded that respect which it deserves, and at the present time it must be said, speaking of the Commonwealth as a whole, that this industry is not in as satisfactory a position as it should be, in view of its value as an adjunct to the farm. The pig is an adaptable animal; that is to say, it fits itself into its inviron-

ment with but little delay and acclimatises well in many countries. The genial climate all over Australia makes it specially suitable for pig-raising, and in view of the cheapness with which the animals can be fed on open pastures, and the abundance of the yields of such foods as swine delight in, when the seasons are any way good, it is a matter for wonderment that the industry under notice has not by this time reached gigantic proportions instead of occupying the almost contemptible position it is now in. Australia's exports of pig-flesh abroad are so small as to almost deserve to be marked down at *nil*, and it not infrequently happens that supplies of fresh pork, ham, and bacon are insufficient for the requirements of our own people. Truly this is a remarkable, nay, scandalous condition of things in a land where pigs thrive so well, even upon native roots and grasses in some specially favoured localities, and where they can be fattened upon grains, cultivated roots and crops of various kinds, and the waste products of the dairy at very small cost. The Australian farmer has in the past—speaking now in general terms and without reference to the many individuals who are intelligent and thrifty, as well as endowed with a fair share of commercial "nous"—been a man of slap-dash ideas. He has seen nothing smaller than an ox in the live stock department, and paid heed to no area of land less than fifty, a hundred, or, in some cases, several hundreds of acres, and he has not favoured any system of husbandry that did not give him his returns in pounds sterling, such sums as shillings and pence being too small to be deserving of respect. Thus it was in so many cases in the past that the pigs and poultry were held in contempt, or something akin to it, and regarded as of such small importance that the question of improving them by proper methods of breeding seldom if ever came up for consideration. The pigs have in too many instances been allowed to attend to their own mating affairs, or, more correctly, so little attention was paid to the question of judicious crossing that it may well be said that their only stud manager was Dame Nature. Anything has, on many farms, been regarded as good enough to breed from; any place has been looked upon as clean enough for their homes; and any treatment has been deemed sufficient for all requirements. What wonder if pigs have, in such conditions, proved a loss instead of a profit? What wonder if they have fallen in favour in proportion to the neglect they received, and been further neglected as they fell more and more in disfavour?

The foregoing is by no means too sweeping as applied to many places where pigs are raised; but it must not, at the same time, be forgotten that there are glorious exceptions to this condition of things. In some parts of the continent swine breeding has been conducted on sound lines, and fine financial returns have been yielded. The trouble is that these exceptions are not to be met with frequently enough, and therefore a condemnation which may appear harsh is found, on inquiry, to be all too just; the fact being, speaking for Australia as a whole, that pig-raising is fairly

classible as one of our neglected industries. America has no better natural advantages than this country in this direction, yet she has built up and is still building up an enormous trade in pork goods in multitudinous forms, in tins and out of tins, smoked, dried, and fresh, and making a name throughout the world for the excellence of its many products of the pig pen. The pig is turned there to full account. It is bred with judgment, fed with scientific exactitude, killed and cured according to the most modern methods, and every portion of the creature is put to some commercial use. "Yes, sir," said the American, while showing a visitor over a big Chicago hog-curing establishment, "we use up everything here but the squeal, and we are trying to invent a machine now to convert that into motive power. When we get that we shall say we have reached perfection, but not till then." This is extravagant, but it illustrates the thoroughness of the American methods in this regard, and it also affords a violent contrast to the poor progress Australia has made in this business of working hogs into money and tapping the markets abroad.

The pig industry is altogether a settlers' question. No one else but farmers can meet the pork wants of the world in anything like an adequate manner. The cottager can, under certain circumstances of remoteness from other habitations, keep a few pigs with profit, and so can the hotelkeeper and boardinghouse proprietor, or other person having waste food which would be lost if not eaten by pigs; but the contributions of all these people to the hog output of any country are insignificant. It is to the farmers and dairymen we must look for our supplies, and these people will be lacking in their duty to their industry, their country and themselves if, in the future, they fail to realise that the people of Australia and of countries abroad want pork goods and are prepared to pay for them with sufficient liberality to amply compensate growers who conduct their operations on proper lines.

THE BEST BREEDS FOR AUSTRALIA.

The several kinds best known here are Berkshires, Yorkshires, Tamworths, and China pigs, and where breeding has been carried out in a thorough fashion, these varieties have been found to thrive well. Different climates, however, have produced varying results in the various breeds; and it has been found that while some varieties thrive well in some districts, they failed to give satisfaction in other places. Little trouble is, however, caused at present in the way of losses through climatic unsuitableness, because the experiments of the past have enlightened breeders on the subject of adaptability of breeds to the cold and hot, wet and dry regions.

BERKSHIRES.

The Berkshire has been found to be the best breed of pig that thrived well in most parts of Australia, hence it is to be met with almost everywhere the swine industry holds sway. It is a good

doer, matures readily, and is fit to kill early in life, while the quality of its flesh is such that it has earned the esteem of the killers for the fresh meat market, as well as the curers of bacon and hams. To dwell upon the virtues of the Berkshire pig would be to perform an entirely unnecessary task, for its characteristics are well known in almost every locality where the grunt of the pig is heard; but it is not out of place to sing its praises in brief manner, for to neglect doing so would be to do an act of injustice to the king of the swine family.

GOOD POINTS OF THE BERKSHIRES.

1st.—Great muscular power and vitality, which render them less liable to disease than any other breeds.

2nd.—Activity, combined with strong digestive and assimilating powers; hence they return a maximum amount of flesh and fat for the food consumed.

3rd.—The sows are unequalled for prolificacy, and as careful nurses and good sucklers.

4th.—The pigs are strong, smart, and active at birth, and consequently are less liable to mishaps.

5th.—They can be fattened for market at any time, while they may be fed to any reasonable weight desired.

6th.—Their flesh, although very fat, is the highest quality of pork.

7th.—Power of the boar to transmit the valuable qualities of the breed to his progeny more strongly than any other breed.

8th.—Their unsurpassed uniformity in colour, marking, and quality.

YORKSHIRES.

This pig is much liked by some breeders, but the fact that it is not so frequently met in the pig breeding districts proves that, to some extent at least, it has been tried and found wanting in comparison with the more favourite breed previously mentioned.

TAMWORTHS.

Quite a warm controversy is constantly raging in some districts on the subject of the virtues and faults of this breed. The Tamworth, or red pig, is unmistakably in a class by itself, his reddish-brown colour, long legs, and somewhat slabby and ill-fleshed ribs being characteristics that belong to this breed alone. The description given of the animal is sufficient to denote its unsuitableness as a meat maker, and to justify, to an extent, the all-round condemnation of the anti-Tamworth section of the controversialists. "If I had my way," says a Melbourne pig salesman, "I would put all the Tamworths in the world on board a big ship, send the vessel out to sea, and sink her in a nice deep spot, so that there would be no chance of the cargo swimming ashore." This is an unqualified

comment, and fully meant by the author of it; but when asked if it be not a fact that the first cross between the Tamworth and Berkshire produces the best killing pig that comes into the market, the salesman admits that it is, and inferentially allows that perhaps it would be rather drastic treatment to drown *all* the members of the breed as he suggests. As a matter of fact, the Tamworth-Berkshire crossbreds that are sold in the Warrnambool (Victoria) market weekly yield the best prices on an average, and that fact, in such an important pig-breeding centre, speaks something in opposition to what the Melbourne critic has to say. It may be given here, on the authority of the best known breeders, that while the cross mentioned gives such excellent results as it does, in the way of modifying the tendency to fat possessed by the pure Berkshire, the Tamworth is comparatively valueless for second cross breeding. A half-bred "Tam" will not mate nicely with other half-breds, or, in other words, if pure or crossbred Berks be mated with a crossbred Tamworth, a deterioration of progeny immediately sets in. This is an important point in respect to the controversy, and means that, good and all as the red pig is in one direction, it is bad in another, hence the question of whether the breed be worthy or unworthy will all depend upon circumstances.

Points of the Tamworth.

Colour.—Golden-red hair, on a flesh coloured skin free from black.

Head.—Fairly long; snout moderately long and quite straight, face slightly dished, wide between the ears.

Ears.—Rather large, with fine fringe, carried rigid, but inclined slightly forward.

Neck.—Fairly long and muscular, especially in boar.

Chest.—Wide and deep.

Shoulders.—Fine, slanting, and well set.

Legs.—Strong and shapely, with plenty of bone, set well outside body.

Pasterns.—Strong and sloping.

Feet.—Strong and of fair size.

Back.—Long and straight.

Loin.—Strong and broad.

Tail.—Set on high and well tasselled.

Girth.—Deep and full round heart.

Sides.—Long and deep.

Ribs.—Well sprung and extending well up to flank.

Belly.—Deep, with straight underline.

Flank.—Full and well let down.

Quarters.—Long, wide, and straight from hip to tail.

Hams.—Broad and full, well let down to hocks.

Coat.—Abundant, long, straight, and fine.

Action.—Firm and free.

Objections.—Black hair, very light or ginger hair, curly coat, coarse mane, numerous black spots on skin, slouch or drooping ears, short or turned-up snout, heavy shoulders, wrinkled skin, in-bent knees, hollowness at back of shoulders.

THE CHINA BREED.

The Chinese pigs are regarded as too delicate for most places, but in any case the kind runs too much to fat, and except crossed with leaner varieties, it gives but modified satisfaction as a producer of its kind.

FEEDING AND TREATMENT.

"A pig roots because it wants to," was the reply of the unimaginative farmer when asked a question on the point. That is so, undoubtedly, but to be more exact, the pig roots either for food or to supply itself with some particular kind of diet that its nature requires. When its wants are fully met, the pig prefers the *dolce far niente* to the trouble of rooting; therefore it pays better to supply all the legitimate requirements of the animal than put it to the trouble and flesh expense of rooting, for energy in such cases means money. At the same time, a moderate share of shallow rooting is of advantage to store pigs, more particularly if there be something good to root for. Johnston grass—a troublesome plant, by the way, to get out of hand in an orchard or other cultivation area because of its spreading habits—is a very good root-producer for foraging pigs, and when turned into a crop of it, they will follow up the sweet tuber-like roots with great relish, and fatten as well as keep in health. A lucerne paddock also gives good rooting results, while a field in which peas have been grown to ripeness supplies abundant grain for the foragers without the toil of rooting beneath the soil. Maize and amber cane stubbles are profitable places for the hog family, while many uncultivated paddocks, as well as those under crop, yield native roots and other growths which are useful as cures for constipation. Some pigs root from habit, out of sheer cussedness, so to speak, and when they do this it is hard to break them of it, even by imprisonment in a sty, for when there they sometimes do not rest until they have torn up the floor, or maybe rooted themselves into freedom.

FEEDING FOR PORK.

The maxim of the pig man is that to make pork cheaply it must be done early in life. The breeding sow should be in good condition before the progeny is born, and kept in good condition while suckling. The youngsters thus not only come into the world well nourished and contented, but they maintain their predisposition to flesh if abundantly supplied with milk. Clean quarters and

warm sunshine are conducive to flesh making, for they impart health. When about three weeks old the youngsters should be encouraged to eat, by feeding them in a shallow trough with tempting food. After they start eating, coarser food can be given, and once started out as caretakers of their own fortune, they can be weaned at eight weeks old and kept in condition until the time comes for fattening. At three months old feeding in earnest can be commenced; better then than some months later, for not only is time lost by delaying, but food is put to better meat purpose in a growing than in a matured pig. Experiments have shown that there is a large difference in the weight of pork made from a given amount of food supplied to a young and an old pig. The former can gain a pound in weight from four pounds of suitable feed, while it takes from eight to ten pounds of food in the latter case to raise the weight of the subject one pound. This means briefly that the pork of the young pig is secured at half the price of that of the other, and that is a consideration worthy of attention.

THE CASH RESULTS.

A writer of note, dealing with the subject of pig-breeding and the profits that are derived from the natural reproductiveness of the animal, thus tersely states the case from his point of view:—"It is impossible to go into minute details as to prices, profits, etc., seeing that localities, value of land, etc., vary so much; but will the reader consider the following facts:—A fair, good-breeding sow can be purchased, say, for £2 10s. She should, with proper management, produce two litters of pigs in the year, and, at a low average, say, seven pigs to each litter, or fourteen in a year. In ordinary times these young pigs are not many weeks old when they are worth 10s. a head in the market, making £7. Now, the question may be asked, 'Is there any other stock that will leave this return, taking the first outlay and expenses for keep into account?' I say no."

FARM NOTES.

By FRANK L. FAULKNER.

Farmers who are situated in the later and more southerly districts should now be well on with their seeding, and should endeavour to bring it to a close as soon as possible. Crops that are sown late should be of a more quickly maturing variety, should be sown thicker, and manured more heavily. I think that in the later districts where late sowing is practised farmers would do well to try the heavy tillering wheats and put them in early. Under these conditions the wheat has a longer growing season and has more

time to stool out and thicken. These wheats, however, when sown late often spend most of the rainy season in spreading over the ground, and then, when they begin to run up, the season terminates, blights them in the ear.

Farmers in the earlier districts who have not yet finished their seeding, and have not got their land prepared, would do well to consider the advisability of stopping sowing, setting their ploughs down as deep as the land will permit, and leaving the land for bare fallow or a summer crop until next season. It is a case of comparing the advantages of a medium or poor crop this year against the chance of an exceptionally good one next year.

Land ploughed up at this time of the year and brought to a fine mellow tilth by the time the weather begins to warm, is the most likely to give good results with summer crops such as sorghum, maize, millet, etc. Crops such as these, if kept well horse-hoed and put in with a fair dressing of manure, give practically all the advantages of bare fallow, excepting that they drain out the moisture reserve that would otherwise be kept as a reserve for the following wheat crop. However, with stock at their present price, a crop in the summer time, when green feed is so scarce, should more than repay a little loss on the following crop.

It is now too late to sow rape for green feed, as by the time it has grown there should be any amount of natural pasture to last for a few months. Farmers, however, should try and make provision for the long dry summer. The sorghums and millets mentioned above are very useful for this purpose if given a fair chance, and any of the well-known varieties are useful. Early amber cane and early orange cane are two very useful varieties of sorghum, palatable to stock, and standing dry weather well.

Sorghum, however, should not be fed until it is well filled in the seed, as it is bitter and unpalatable to stock up to then, being even poisonous, containing prussic acid in small quantities.

It is a good plan to plant a patch of maize. This will develop earlier than the sorghum, and by the time the maize is finished, the sorghum is ready.

I have seen maize, millet, and sorghum all mixed together, with very good results.

Kale, as I mentioned in last month's *Journal*, should prove a very reliable source of summer fodder. The orthodox way of putting in a kale crop is to heavily manure and deeply plough the land, and then transplant the young plants about three feet apart each way. It is then hand harvested—stripping the leaves by hand and feeding them—and is considered a two years' crop, invariably giving a better crop the second year. The system, however, is very slow, laborious, and expensive, and unless the land you are cropping is very rich and will guarantee a very good yield, the crop will not warrant the expense. The system of drilling in the seed about half or one pound to the acre in rows about two feet apart and mixing

the seed for one acre with about two hundredweight of superphosphate or bonedust, is simple and comparatively inexpensive. If the crop is started during this month or even next, stock being kept off and the land between the rows fairly clean by cultivation until October or the beginning of November, it will, with ordinary luck, obtain a good start and be found to stand a lot of feeding during the summer months.

If required, this crop can be left to give feed during the following winter and summer; but I am only advocating the system as a summer crop, on land that is intended for cereal the following winter.

At the Roseworthy Agricultural College in South Australia, last season, two acres of Jersey free kale put in this way on poor limestone brash carried 50 head of sheep, from October to December, for eleven weeks, and at the end of the time the sheep were removed for a change, but there was still good feed on the patch.

Farmers having a patch of good land, alluvial, or with an under soakage, will find that by transplanting the kale and manuring it heavily exceptionally heavy returns will be obtained.

Lucerne, as briefly described in my article in last month's *Journal*, is a splendid fodder for the last-mentioned soil, and on well-prepared land could be put in now.

Peas make a splendid crop to sow now on land that is intended for cereal next year. They should not be put on land that is too damp or wet, and prefer if anything a limey soil. Do not manure heavily with stable manure previous to a pea crop, or the result will often be that the peas are unhealthy and blighted. The explanation of this is that the stable manure supplies an excess of nitrogen for the requirements of peas compared with its other manurial constituents, and as peas have the power of drawing their supply of nitrogen from the air (a power that only plants of the same order, viz., beans, vetches, clover, etc., possess), they seem to be supplied with an excess of nitrogen.

The phenomena of obtaining the nitrogen is performed through the agency of bacteria (minute microscopic forms of animal life) that inhabit the roots of plants of this order. Small bulbs or "nodules" are readily seen on the roots of these plants, and it is in them that the bacteria are to be found.

The above paragraph will also explain the fact that so many farmers have noticed, *i.e.*, the beneficial effect of a pea crop on the succeeding cereals. This fact should be all the more appreciated when it is pointed out that of all the manures most likely to become deficient in the soil those supplying nitrogen are the most expensive.

If a pea crop only pays directly for the labour and expense of itself, it will pay well to grow it on a farm on account of its bene-

ficial effect on the land and on the succeeding crops. In putting in the crop the land should be deeply ploughed as for fallow and then brought down fairly fine. In the early districts they should already be sown and in the later ones from now on. My experience has led me to think the early sowing is preferable. The best method of putting them in is with the drill, but as the force feed of the seed delivery splits them rather badly it is a good plan to mix them with the manure and distribute them through the manure feed. Mix one-and-a-half to two bushels of peas, with one to two-and-a-half hundredweights of superphosphate and a little potash manure and distribute on an acre. In drilling it is a good plan to stop every other hoe from running, or better still let two hoes run. Stop the next two and so on. This admits of horse-hoeing until the crop begins to trail over the ground.

The horse-hoe should be used as much as possible until the rows become too much entangled, as peas have a tendency to foul the land; oats and such weeds thriving when surrounded by pea plants.

Regarding the varieties, any of the field peas are hardy and useful, but the "Grey pea" is, if anything, earlier and better. Early Dunn is also a good variety. In harvesting, I think the most efficient method is with the ordinary horse-rake, raking up into heaps just before the pods ripen. Keep these heaps well turned and aired to prevent moulding, and do not work them in hot weather, as the pods burst and loose badly. If possible, handle in the cool weather or the early morning.

Get the crop under cover as soon as possible, as rain has a very detrimental effect on the straw and grain.

For cleaning, the best plan is to tread or roll out the heap and pass through the winnower with a coarse screen in.

Pea-straw well harvested is very useful fodder on a farm, stock eating it readily and clean. What is left in the field after harvesting is picked up clean with a flock of sheep or pigs. Peas can be very economically fed off in the field, turning in the stock for a couple of hours each day. Cows fed on a green pea crop milk heavily and give produce of good quality. Care must be taken, however, that they do not get "blown." In this method of feeding the land gets the benefit of the manure from the stock..

In putting in cereals after, if the pea crop has been well worked, the land needs no more than a thorough scarifying and once harrowing previously to drilling, and if well manured a light dressing of superphosphate will suffice.

All farmers, as soon as their seeding is completed, should see that the ploughs are in order and that all the horse strength possible is put on, in order to get a good acreage of fallow ready for the following season.

On a well-worked farm the plough should be called into use very little during the seeding. All the land should be previously

prepared, and the work of seeding to consist of making the seed bed and sowing the seed; but directly the seeding is over ploughs and all the horse power available should be got into shape and put to work.

On farms in early districts fallowing should already be in full swing. "Fallowing" is a method of preparing and cultivating the land for a period of nine or ten months previous to sowing it with the crop. In these States it is chiefly used for the growth of cereals, and, as I stated in last month's *Journal*, is the means of obtaining conditions as near perfection for the growth of these crops as the district will allow.

It is particularly adaptable to large areas, and is scarcely less adaptable to small ones. For a large farmer it is a means of doing that part of the work which is the most laborious and slow, at a time when there is no immediate hurry, and thus when the time comes for seeding he can avail himself of opportunities that the season offers, and while the work at this period is made much lighter it is also much more thorough and effective.

For the farmer whose acreage is limited, fallowing is a means of getting as large a return off a smaller number of acres than he would require for the same return on a less thorough system. This also applies to the large farmer, and a very common cry with them is, "but what is to be done for stock feed during the winter, spring, and summer." To this I think the answer is "crop less and do it better," and "do not keep more stock than you can conveniently carry." Again, instead of growing medium and poor crops, and getting your land filthy with weeds as a result, why not grow good crops, and if necessary feed the stock on hay and chaff; or, better still, silage for the few months of the year when feed is scarce.

The trouble of summer feeding can also be largely overcome by a little attention to summer crops. For the production of stuff for silage it is a good plan to have two small paddocks near the stables, to which is carted all the stable manure. These can be made to carry a crop of any suitable mixture of cereals and a little rape, mustard, etc., mixed in, every alternate year. The other will have the season's dung carted out into it, and either bare fallowed or made to carry a summer crop. From now on to the end of July is a good time to get the manure pit cleaned out, the farmyard cleared up, spreading the manure as far as it will go on the field that is lying out, and ploughing it up thoroughly.

To summarise, all cereals should be finished with for this season as soon as possible, and all land, whether for fallow or for summer crops, should be ploughed up deeply, and the sooner the better, as then it will be benefited by the winter rains giving it a thorough soaking to the subsoil.

HORTICULTURAL AND VITICULTURAL EXPERT'S REPORT.

MAY, 1904.

The Acting Director of Agriculture.

During the month of May I went on a round visit to Katanning, Albany, the Porongorup Hill, and Mt. Barker.

In every direction around the centres visited there is marked evidence of active progress having been made of late years in fruit growing.

At Albany, in company with the local Inspector, Mr. Breen, I made a tree-to-tree inspection of all apples, pears, and quinces now growing within the area last summer quarantined on account of the discovery of an outbreak of the codlin moth. The area is restricted to a portion of the town itself, and contains 81 trees growing in 23 gardens.

Instructions are being issued to owners to have 18 of these trees, which are neglected and are a menace to the other orchards around, grubbed out and burnt on the spot.

A number of trees are so high that they cannot be properly sprayed, viz., 34. They will be cut back to such height as will permit their easier treatment and examination by the inspectors.

The other 29 trees will not for the present be interfered with. All these trees within the area will be properly bandaged and sprayed with Paris green at the most suitable periods to reach any codlin grub which might hatch in the spring. During the time these gardens are quarantined the owners will be debarred from marketing their fruit, which will be stripped under the direction of our inspectors before the codlin grub have had time to reach the full-grown stage. By a strict observance of the measures to be issued, I hope that this Southern outbreak, like the other which has concurrently been reported in Perth, will be stamped out.

The co-operation of owners of the gardens concerned will, I daresay, be readily given; but, on the other hand, every case of neglect or non-compliance with the order issued will be promptly brought under your notice for further action.

As a fruit-growing district, the Porongorup Hills bid fair to rival Mt. Barker, which enjoys the important advantage of being on the railway line. After a visit to some of the orchards of that locality, I delivered in the evening, under the auspices of the Mt. Barker Rural Association, a lecture on fruit growing, and arranged, when visiting the district again in June, to give a pruning demonstration.

On my way back I stopped at Narrogin, and had a consultation with the manager of the State Farm respecting the establishment of an orchard and a vineyard at the farm.

During the month the inspection of orchards has been directed mostly towards checking the fruit fly pest, which proved very destructive to pears and quinces, in some cases to some kind of apples, notably Five Crown Pippin, Cleopatra, and Sturmer Pippin, which are light-coloured apples.

At this time of the year persimmons are also attacked in the affected districts, as well as the earlier mandarines and split oranges. Every now and again some oranges are found wormy, but in the majority of cases it seems as if young larvæ hatched from eggs deposited in the rind perished before reaching the pulp.

On the whole, the fruit fly has not been so severe this year as it has been in previous seasons, although towards the early autumn it did a good deal of damage in a number of orchards.

The news cabled by Mr. G. Compère from Brazil, of his success in locating an affective parasite for the fruit fly, which for some years has been a source of trouble in some of our fruit-growing districts, has been gladly received by every grower.

Orchardists are applying from every part of the State for colonies of the ladybirds and of the insect parasites, of late years introduced, of the Aphis and the Scale pests.

During the month of May 70 colonies of beneficial insects were distributed amongst 49 applicants, and as these insects breed and spread in every direction where they find suitable food, a great number of orchardists will derive benefit from their presence.

During the month every registered nursery was also closely examined and the stock declared clean of the more troublesome pests. As in previous seasons, this inspection will not relieve nurserymen from fumigating, as prescribed by this department, all the trees they send away, and furnishing to every customer a statement to that effect at the same time as the invoice note is issued to them.

The returns of fruit and fruit trees introduced during the month of May show that 16,368 trees or plants were introduced, about one-third of which are apples. Of fruit, 8,453 cases were imported, of which 7,642½ were passed and 810½ destroyed, mostly on account of decay; of this number 184 cases were destroyed on being found infested with the codlin grub, mussel scale, or fruit fly maggots. Of the fruit introduced, 3,296 cases were apples from the Eastern States, 1,948 cases bananas, presumably from Queensland and Fiji, and 1,811 cases Mediterranean oranges.

A. DESPEISSIS,
Horticultural and Viticultural Expert.

8th June, 1904.

HINTS TO STOCK-BREEDERS.

By R. E. WEIR, V.S., C.I.S.

In view of the increasing land settlement in this State, a large amount of which is being utilised by the settlers in the pursuit of stock-raising, it has been considered advisable to frame a short treatise on the matter, for the information of those newly arrived in the State, who it is natural to assume, are not over well acquainted with its advantages, and the facilities offered for the prosecution of this important industry.

Our climatic conditions do not largely differ from those of the Eastern States, and if at all, only on that side where an advantage accrues by a more even temperature. This latter also applies to the north-western portion of the State, where the tropical climate is especially suitable to cattle-raising, and where the principal grazing of the State is centred.

The coastal districts more than favourably compare with many of the long settled pastoral districts of the Eastern States, being well watered and generous to the cultivator. The quality of Stock at present in the State is good, both from a point of breed and the manner of development.

DAIRYING.

The Government have a variety of stud stock which is placed at the disposal of farmers for the purpose of improving or tempering the strains. This advantage is readily seized by those engaged in the dairying industry, which is slowly but surely coming into prominence, and as the prices of grain and hay are gradually lessening, it is anticipated that dairying will forge ahead, and become one of the chief industries of the State. The south-western portion of the State is specially adapted for this purpose, and when the drainage scheme, which the Government at present have in hand, is fully completed, a considerable area of land will be available for cultivation of green fodder, which is absolutely necessary to assure success in this line.

Many dairy farms have been undertaken on land which is entirely unsuitable for the purpose, the land being only of the medium class, and unable to provide the necessary grasses which are indispensable to dairy cows.

The scope in this industry here is much in advance of any other portion of the States, this fact being demonstrated by the prices given for both butter and milk, and further, what is probably a more conclusive proof, is in the quantity of butter imported per annum, being for 1903, 6,219,601lb., the value of which was

£285,587, and of condensed and pasteurised milk for the same period, 5,963,187lb., the value of which was £996,644.

It would be well for new settlers intending to go into this particular branch, to consult the health authorities for the purpose of ascertaining the conditions necessary for the erection of buildings, etc., in order that the requirements of that body may be immediately fulfilled, instead of alterations having to be made later to bring same into conformity.

As previously mentioned, for the purpose of fostering dairying in this country, the Agricultural Department have many good stud animals, which are leased to settlers at small remuneration wherever their services are required.

The present price for cows in milk is from £15 to £20, and this, in the past, has been the reason of preventing many from going into this particular line, who, with a little capital, might otherwise have done so.

Many dairy heifers are now reared locally, and as these will be coming into the market each year in increasing numbers, the price paid for this class of cattle in the past will naturally come into line with the prices obtaining in the Eastern States.

The most popular breeds are the Shorthorn or Durham, the Ayrshire, and the Jersey, but for profitable dairying, both as a milk producer and as a beef animal after becoming dry, undoubtedly a cross of the Shorthorn and Ayrshire cannot be excelled. The Agricultural Department have some very fine animals of the Dexter class at their Experimental Farm on the Chapman area. These animals are peculiarly adapted for country where the forage is light, or where it is difficult of digestion on account of coarseness. They are small compared with the other breeds mentioned, but as milk producers are considered to be very prolific. They are easily kept in good condition, and recommend themselves to those portions of the State where the larger class of animal will not thrive.

PIG KEEPING.

An industry which goes hand-in-hand with dairying is pig raising, and in view of the recent outbreak of swine fever in this State, which carried off a great number of pigs, and which has now been practically eradicated, this should prove a profitable occupation in the future. The management and keeping of pigs has so often and ably been set forth at length that it would be unnecessary, as well as impossible, on account of the space allowed, to give more than a few conditions which affect us locally.

The reason accountable for want of advancement in this branch of live stock keeping is chiefly due to laxity in breeding. Many breeders here have used a class of boar which is totally against any improvement being made. Others, again, have indulged in inbreeding to such an extent that the animals have become stunted and unthrifty. This is still very noticeable with many of the

supplies which now come into the market, and the prices realised in consequence are 50 per cent. less than others of the same age where more care has been taken in the breeding. This method of rearing pigs, no matter how they are got, tends also to weaken the constitution, and exposes them more readily to disease, with which they might not otherwise have become affected. This was forcibly brought to the notice of the Department during the recent outbreak of swine fever, where weedy pigs, trucked from the country, became subject to colds and readily succumbed, where many of the improved breeds survived.

A cause of much trouble amongst stock of this class is the presence of sand within the alimentary canal, producing unthriftiness, and frequently inflammation of the bowels. For this reason, measures should be taken to prevent, as much as possible, ground of this nature being included within the sties and runs, or to have such ground covered with grasses as soon as possible. Care should also be exercised during the summer months in preventing stud stock from becoming too fat. Many valuable animals have been lost owing to this cause during the past season, where, if a little more care had been exercised, this could have been avoided. Special provision should be made for boars in providing comfortable and airy sties, also a run where exercise may be taken and green food cultivated.

A popular idea at one time was that pigs throve best in filth, and they were in consequence systematically neglected, so far as their sanitary comforts were concerned. This theory has, of course, long since been exploded, and the fallacy of same has been demonstrated by those more humane and industrious breeders who place cleanliness in a position of first importance, thereby naturally obtaining the best results. It is, therefore, not surprising to note that (with few exceptions) the premises visited with the swine fever scourge during the recent outbreak were those where sanitation is either entirely disregarded or taken very little into account, and where pigs have been allowed to exist in filth. Such premises have the dual disadvantage of being a source of danger to public health and a source of material pecuniary loss to the owner.

At least once every month lime should be freely spread over the runs and sties. This will act as a preventive against disease, especially fevers, and at the same time prove a valuable addition to the manure, which is so necessary for the land.

The most popular breeds in this State are the Berkshire, Tamworth, English Large Black, and a few of the Yorkshire. I have, I think, named them in their order of importance, *i.e.*, according to the extent to which they are respectively cultivated.

Whatever the nature of a farm, a few pigs, though requiring a certain amount of attention, are a valuable, and almost indispensable adjunct, as (particularly after harvesting) material, which otherwise would go to waste, may be profitably used for fattening.

DISEASES.

INDIGESTION.

This is usually the result of improper food, also from the animal partaking of its food in a ravenous manner. In the case of suckers, it is sometimes the result of feeding on cold milk. The symptoms are: loss of appetite and usually increased thirst; the animal falls off in condition, and has a dry, skurvy skin; the bowels are irregular, and as the disease develops a dry cough may occur.

Treatment.—Ascertain the cause, if possible, and remove it. Even if the cause should not be traceable to the food supply some alteration in the animal's diet will frequently bring about favourable results. It is usually advisable, unless diarrhœa is excessive, to immediately administer a mild aperient; 2 to 4 ozs. of castor oil (depending on the size of the animal) will have the desired effect. After the laxative, small doses of bi-carbonate of soda and gentian should be administered until recovery takes place. The food should be of an easily digested nature, given frequently in small quantities.

PARASITES.

Worms are frequently the cause of much trouble and loss amongst pigs throughout the State, and although it is sometimes difficult to ascertain when the animal is suffering from parasites, it is always possible to treat the pig without impairing its health.

General symptoms.—The animal will be unthrifty; coat dry and spare; feeding irregular and loss of condition; sometimes colicky pains will be noticeable, and parasites of various sizes may be found amongst the fæces.

Treatment.—The extract of fern root, in dram doses, is usually effective, but the following powder mixed with the food will be more readily taken:—

Iron sulphate	1 dram
Copper sulphate	1 dram
Salt	9 ozs.

Mix and give one small teaspoonful daily to each animal in the food supply.

INFLUENZA.

This is an infectious febrile disease, usually very prevalent during the latter part of winter, or the early spring, when the cold winds are most frequent. Young growing pigs are most subject to this malady. The cause of same is usually sudden changes of temperature or to exposure in unsheltered sties; also to defective food. The mucous membranes of the eyes and nose at first become dry and red, then very soon become moist and discharge a thin watery secretion, which eventually becomes more dense and copious. The animal sneezes, and usually a cough is present. Febrile symptoms usually run very high, and diarrhœa may be present. If the animal does not recover in a few days, lung complications may occur, which frequently terminates fatally.

Treatment.—Isolate affected animals, and place in warm comfortable sty. Apply mustard, mixed with cold water, to the throat, also to the chest immediately behind the shoulder blades. Give small doses of liquor ammonia acet., Epsom salts, and nitre. This will allay the fever. The food supply to be given hot, and sufficient cold water supplied for drinking. Disinfect the premises.

CONSTIPATION.

This may be looked upon more as a complaint than as a disease, although some animals are naturally subject to this condition. So long as the animal remains in health, there is no necessity to employ active measures for the removal of the constipation. All that is necessary is a change of diet, which should be of an easily digestible nature. The cause is chiefly due to overfeeding and insufficient water supply. Sometimes it may be due to mechanical means, such as a tumour within the intestines, thereby blocking the passage.

Treatment.—As the disease is usually due to overfeeding, the supply of food should immediately be minimised, or altogether withheld. A small dose of sulphur and sulphate of magnesia given in the food, may have the desired effect. In the event of this being ineffectual, castor oil should be administered, and repeated in 24 hours if necessary. If there is a tendency to return to the state of constipation, common salt and sulphur, given in small doses in the food, will have the effect of counteracting the trouble.

DIARRHŒA.

This term is applied to all cases of simple purging, without being associated with any other disease, and yet it may only be a spontaneous effort to dispel some obnoxious matter from the system. The principal causes are: sudden changes of food, especially to food of an indigestible nature, and particularly to a change from dry to moist diet. It may be also due to a parasite within the alimentary canal. It is a common complaint with young suckers, and is brought about by some changed condition in the milk supply. In the treatment of this disease, the owner must be guided entirely by the cause. This must be immediately removed, and it is usually safe treatment to cleanse the bowels with a mild aperient, such as castor oil, and at the same time change the food, which should be of the simplest kind, such as wheat flour boiled with a little carbonate of soda and given with the food after the oil has operated. Where young suckers are affected, the sty should be made thoroughly clean and warm, and the dam's food given fresh and wholesome.

PROTRUSION OF THE RECTUM.

This sometimes happens from costiveness. The bowel is forced out, and appears like a fleshy tumour beneath the tail. Weakly and over-fat pigs are the most likely to suffer. By way of treatment, the gut should first be bathed with warm water, to which a little carbolic has been added, and after oiling, seize with the

left hand and gently push back with the fingers of the right. No solid food must be given for at least three days afterwards. In the event of the gut becoming obtruded again, it is to be dressed and returned as before. In the event of constipation being the cause, the bowels are to be freely opened with castor oil.

SWINE FEVER.

This is an infectious febrile disease, resultant from the presence of a small organism in the blood and tissues. The symptoms are: loss of appetite, weakness, hanging ears, sullen appearance, watery eyes, and dirty secretion about the eyelids. Red spots appear on the ears, abdomen, and on the inside of the thighs. The red spots are at first hot and painful to the touch, but afterwards lose this sensitiveness. As the disease advances, the hind-quarters become paralysed. Complete exhaustion and death follows. The bowels at first are usually costive, but afterwards diarrhœa of a very severe nature sets in; the breathing becomes difficult, also, a painful cough is present. The foregoing symptoms vary in many instances, depending, of course, greatly on the intensity of the fever.

Prevention. —Preventive measures embrace not only the treatment of the animal, but pigs purchased in the open market, should be quarantined for 14 days (this being the incubation period), at least 100 yards distant from all others, when, providing no suspicious symptoms are present, they may be allowed to mix with any others that may already be on the premises. After each lot has been removed from the quarantine pen, the premises require to be thoroughly cleaned out, and the floors, yards, etc., covered with lime. Pigs showing suspicious symptoms should be immediately removed from the others, and the Stock Department advised, when precautions will be taken by that body to have the infection eradicated.

During the recent swine fever outbreak in this State, inoculating experiments were conducted by this Department with very successful results.

SHEEP.

This branch of agriculture has been well cultivated, and formed one of the chief sources of revenue to the State prior to the development of the goldfields. Many, who, in the early days took part in this industry, are now reaping an abundant harvest as the result of their labours, and a few of the very successful ones are living in affluence within our metropolis. No branch of agriculture gives better results on the capital invested than sheep husbandry, and, with the exception of East Kimberley, and a few small poison areas, the whole of this vast State may be utilised for this purpose.

When the industry was first established here, the Merino was chiefly in evidence, that class of wool being in great demand; but an active demand having set in for mutton, latterly the crossbred has come much into prominence. The former, however, will always

remain the squatter's sheep, but in the case of small holders and farmers, the crossbred is certainly the more productive.

Those who wish to make this branch of agriculture a specialty, must not forget that the first essential is a plentiful water supply; also, when the seasons are good, and food plentiful, they must not be tempted (as many have done in the past) to overstock their runs, thereby exhausting their pasturage, and being the means of heavy mortality through impoverishment, when, late in the season, food becomes scarce. The most common diseases in sheep are briefly dealt with in the following:—

IMPACTION.

Owing to the dry and frequently coarse nature of the herbage, a great number of sheep suffer from this complaint. The rumen, or paunch, becomes distended with food, and will not yield under pressure. The usual symtoms are, a falling-off in condition, rumination ceases, and if pressure is brought to bear on the left side it will be found hard and unyielding. Small doses of linseed or castor oil, if repeated every second day, and given early in the stages of the complaint, will frequently effect a cure. The animal should afterwards be removed to pasture of an easily digestible nature.

ENTERITIS.

This complaint, commonly known as inflammation of the bowels, is a disease from which sheep frequently suffer, especially if suddenly removed to a totally different pasturage.

I recollect an instance, a few years ago, where a small local grazier purchased a few hundred store sheep for fattening purposes. The sheep had just been shipped from Derby, at the dry time of the year, and after purchase were placed in pasture, a small portion of which was of a very succulent nature. Here they were allowed to graze at will, and before three weeks had expired, some forty or fifty head died. On my visiting the place and making a *post mortem*, the disease and cause was easily diagnosed, with the result that from that date the mortality ceased. Preventive measures alone were employed. The sheep were afterwards only allowed on the rich feed for four hours during the middle of the day, and were retained on the poorer land, or scrub country, the remaining portion. The early symptoms are those noticeable with colic, though afterwards becoming aggravated. The animal stamps the ground with its feet, and strikes the belly with the hind legs, looks round at the sides, and immediately goes down and rolls on its back. The bowels are usually costive, and an anxious look appears on its face. The strength of the animal rapidly diminishes, and death ends the struggle. The causes are due to sudden changes in diet, exposure to cold, and more particularly to the influence of cold and wet together. Poisons also appear in a similar form, and with similar results.

Treatment.—Remove the cause. If the pasture is too rich, remove to poorer land; and if of too coarse a nature, take the flock to country where the pasture is of a more easily digestible nature. Sheep are not so much subject to poison plants as cattle, but care should be taken where such plants are known to exist.

Remedial.—Bleed, if in the early stages. Act gently on the bowels with oil and Epsom salts, and afterwards use sulphur to assist the action of the medicine.

PNEUMONIA (OR INFLAMMATION OF THE LUNGS).

This disease is of rare occurrence amongst flock sheep, but is not infrequently found amongst stud rams and ewes which are imported into the State by steamer. While on board ship they may be cooped up in a hot part of the vessel, and after landing are perhaps exposed without shelter in an open paddock; as a consequence, a chill is contracted, which only too frequently terminates in inflammation of the lungs. The first indication is that of fever, then disinclination for food, followed by unwillingness to move, and slight heaving of the flanks, with a frequent and painful cough.

Treatment.—The affected animals must immediately be placed in a warm and comfortable building, and given a plentiful supply of cold water to drink. The food should be nourishing and easily digestible. Clip the wool immediately behind the shoulder, and rub a good application of mustard into the skin; also; give a teaspoonful of nitrate of potash (saltpetre) in the drinking water daily. The mustard may be repeated on the third or fourth day.

OPHTHALMIA.

This disease is more common amongst cattle than sheep, and is therefore dealt with in connection with the other diseases affecting cattle, the treatment for sheep being similar.

LAMBING.

The present value of sheep necessitates that greater care should be taken during the lambing season. The person in charge should carefully observe ewes when in labour, but on no account should a ewe be disturbed or assistance given unless actually required, *i.e.*, only when the labour pains have been continued some considerable time, and the strength of the animal is declining, then immediate aid is required. It will then be found that the ewe, having exhausted her strength, will allow the lamber to come to her aid. Having done so, the first duty will be to ascertain the nature of the presentation. If coming the right way, the lamb will be presented with the two fore feet beneath and on each side of the head. The most frequent cause of obstruction is on account of the head being too large for the passage. This was exemplified at last lambing, when a heavy mortality occurred amongst a small number of merinos as the result of their being mated with a Shropshire ram.

All the lambs had short, thick-set heads, and as a consequence many of the ewes were unable to lamb.

A good number died before the cause was investigated and ascertained. In such cases, the two fore legs require to be grasped in the left hand, and one or two fingers of the right introduced into the vagina by the side of the head, and then urge it forward and upwards, at the same time pulling steadily with the left hand at the fore legs. By this means the lamb will be removed.

INVERSION OF THE WOMB.

Unless as the result of violence, this condition is of rare occurrence among sheep. After bathing with hot water, return as speedily as possible, and have it confined by means of a suture through the lips of the external parts.

GARGET (OR INFLAMMATION OF THE UDDER).

Occasionally ewes will be noticed restless, and exhibiting symptoms of pain when the lambs are sucking. Should an examination be made, the udder will be found hot, and painful to the touch, also, one portion may be hard and enlarged. The udder should be cleared of wool, well fomented with warm water, and a mixture of camphorated oil rubbed on the part.

Medicinally.—A dose of Epsom salts will assist in effecting a cure. The animal should be provided with a dry bed to lie on, as the cause is usually due to lying on cold, damp ground.

FOOT-ROT.

This disease, although common in the Eastern States, is of rare occurrence in the West, owing to the dry nature of the runs. It is, however, occasionally noticed in the South-West, where the pasture is more soft and marshy. The first indications are a certain degree of lameness, and if the animal is caught and examined, the foot will be found hot and tender, the sole of the foot soft, and the coronet enlarged, also, a slight separation in the foot will be noticed, with probably a discharge of thin matter. In order to effect a cure, it will be necessary to remove all loose and detached hoof with a sharp knife. Nothing of an unusual nature must remain, otherwise it will act as an irritant and retard the healing process. The foot will then require dressing with a solution of—

1 part of copper sulphate.
50 parts of water.

The sheep should then be placed on dry soils.

SCAB.

This is a disease affecting the skin of sheep, and one that has proved to be most destructive amongst the various flocks in Australia; though, fortunately, owing to the stringent measures employed by way of destroying affected animals, and dipping the

remainder of the flocks, the disease has been successfully eradicated: and it is to be hoped that it will not again make its appearance in Australia.

LICE AND TICKS.

These parasites are commonly found among the flocks in the southern portions of the State, and are the cause of much inconvenience to the affected animals, besides being the agent by which considerable injury is done to the wool. On careful examination, the lice will be found running about all over the body, while the tick, by means of its proboscis, remains firmly adhered to the skin. Regular and systematic dipping with any of the well-known dips will have the effect of eradicating the pests. It would also be well here to state that flock-owners, no matter whether their sheep are clean, will find it very beneficial to dip their sheep once a year. Towards the beginning of winter, and especially in moist country, certain species of fly deposit their eggs on the wool of sheep, which, under favourable circumstances, develop into maggots. Sheep suffering from wounds or diarrhœa are the most likely to become affected, and these require to be carefully watched. The sheep will become uneasy, hanging down their heads, stamping, and probably running about. All dirty wool should be clipped off, and a solution applied to the parts of corrosive sublimate turpentine, or tar oil. This will destroy the maggots.

CATTLE.

The common diseases to which cattle are subject, are briefly dealt with in the following:—

TYMPANITIS (OR HOVEN).

Distension of the rumen, or paunch, by gas, is a frequent and troublesome complaint amongst both cattle and sheep. It chiefly occurs after removal from poor feed to rich succulent grasses, more especially if the latter is wet with dew or light rains. Fermentation takes place and gas is generated, the rumen rapidly distends, and if not speedily reduced, suffocation or rupture ensues. The following measure—two-ounce doses of liquor ammonia or turpentine given in a pint of cold water—usually has the desired effect of reducing the gas. Should, however, the animal show signs of distress, a trochar or large knife requires to be immediately inserted into the rumen, at a point equi-distant between the last rib and the haunch-bone. A dose of Epsom salts is to be administered in either case.

IMPACTION OF THE RUMEN.

Owing to the long dry summer and the sudden changes which follow the early rains, many cattle throughout the State suffer from this complaint, and the losses in the past have been particularly severe. The symptoms are a falling-off in condition, dullness, a disinclination to move about, stiffness in gait, and weakness of the hind quarters. The left flank may be bulged outwards, but differing from hoven, in that when pressure is applied it will be found solid,

and an impression will be left, which takes some time before removal. In the early stage of the disease, relief may be given by administering a full dose of purgative medicine, such as Epsom salts, $1\frac{1}{2}$lb.; ginger, 2ozs.; treacle, $\frac{1}{2}$lb.; common salt, $\frac{1}{2}$lb. Dissolve in hot water, and give the whole as a drench. On the following day administer stimulants, such as spirits of liquor ammonia, in two-ounce doses. Should the animal be found too weak for a full dose of medicine, linseed oil in pint doses, every second day, may be administered; this can be combined with 4ozs. of common salt, and 2ozs. spirits. Food of an easily digestible nature is to be given, and a plentiful supply of water to drink.

RED WATER (OR MUIR ILL).

This disease is not of frequent occurrence here, but in a few instances cases have been brought to my notice. It will be found, as a rule, to occur in either Spring or Autumn, especially when the cattle have been grazing on land that is naturally low and requires draining. The appetite is not much affected, as a rule, in the early stages, but the urine is usually coloured of a red or reddish-brown hue, more especially if constipation is present. The animal is dull, and usually stands alone with its back arched. If the disease is allowed to go unchecked, the urine becomes darker, and the animal rapidly falls off in condition. Seeing that the disease is due to poverty of the blood, the first step to be taken is to remove the animals to better pasture, and, as a rule, this is all that is necessary to arrest the disease. Should medicine be required, a mild dose of oil is to be given, followed by stimulants and alteratives, such as chlorate of potash, in two-ounce doses.

OPHTHALMIA.

From sudden changes of temperature, and especially when cold winds are prevalent, cattle frequently contract inflammation of the eyes, and as the result of dust, flies, etc., others rapidly contract the malady, until the whole herd may become more or less affected; and some may be so severely affected as to cause complete loss of sight. The affected eye will appear swollen and partially closed, the eyelids twitch, and a watery discharge runs down the face. On opening up the lids, the inner lining and eye itself will be found congested and very red in appearance.

Treatment.—Place the affected animals in a cool, shaded place if possible, draw blood from the inner comer and immediately below the eye, and apply once or twice daily to the eye itself, by means of a soft feather, extract belladonna, 6 grains; sol. opium, 4 drams; water, 4ozs.

PNEUMONIA (OR INFLAMMATION OF THE LUNGS).

This disease is of frequent occurrence among cattle, and is specially noticeable after the animal has been overheated (as on removal from the warm hold of a ship) or exposed to cold. The first symptoms are dullness, stiffness, and probably the animal will

be subject to shivering fits; the head hangs low, and the white of the eye becomes congested; a tucked-up appearance is noticeable, and a difficulty in breathing. The animal usually stands throughout the disease, and a favourable sign is when the animal takes a recumbent position.

Treatment.—Place the animal in a well-ventilated and comfortable building, which must be free from draughts. A plentiful supply of cold water is to be provided, and the food is to be of an easily digestible nature. Nitrate of potash (1oz. to 2ozs.) may be given night and morning in the drinking water. This should have the effect of reducing the fever. A mustard blister rubbed on behind the shoulder blade will have the effect of hastening the recovery.

PLEURO-PNEUMONIA EPIZOOTIC.

This in an infectious inflammation of the lungs in cattle, having an incubation period of about six weeks, but sometimes of a longer period. In some instances the disease progresses rapidly. No sooner is the animal noticed to be ill than serious complications result, and the animal dies. In other cases the animal will linger on, and it is difficult to state whether anything is seriously wrong, with the exception that the animal is drowsy and unthrifty. The symptoms are loss of appetite, hot mouth, dry muzzle, and a falling-off in the milk yield, and, as a rule, a husky cough. Later, the animal will be found standing with its back arched, head and neck extended, and when made to move an unmistakeable grunt is heard. A marked falling off in condition is noticeable, and the animal moves about with difficulty.

Post-mortem appearances.—When the chest is cut open and the lungs exposed, one lung especially will be found to be much enlarged and solid, and adhering firmly to the inner side of the ribs. In other instances the lung may be broken down, and a large quantity of fluid occupies the cavity; this will be of a clear sherry colour, and is now commonly used for preventive purposes by means of inoculating.

Preventive measures.—When stock of a suspicious nature are purchased, they should be kept separate from the healthy part of the herd for a period of six weeks, when, should no symptoms of sickness be noticed, they may be allowed to mix with the others.

When an animal has become affected, no remedy is of avail. The animal should be destroyed without delay, and after securing the necessary virus for inoculating, the carcase should be burnt. The virus for inoculating the other animals should, if possible, be secured from an animal in the early stages of the disease; and the operation is performed as follows:—

Clip the hair from about four inches from the end of the tail, and insert a needle (specially made for the purpose, with an eye at the point), from below, upwards about an inch in length underneath the skin, first having attached a piece of white worsted,

well soaked in the lymph, through the eye of the needle, which latter, being withdrawn, the worsted is left in the full length of the insertion. No risk is attached to the operation, providing that no swelling takes place from the 14th to the 20th day. Should this occur, it will be necessary to amputate the swollen portion, and so prevent the infection from entering the body.

TUBERCULOSIS.

A specific disease caused by the bacillus tuberculosis, which develops inflammation, and subsequently causes swellings to appear in the various glands of the body, chiefly those of the throat and udder. The disease is contagious, and is frequently spread by the bacillus, which is contained in the saliva, being mixed with food supplied to healthy animals. The first noticeable symptoms are: a falling-off in condition, dullness, and slight cough; the milk supply does not vary much in quantity, though as the disease advances a falling-off takes place, together with a deterioration in the quality; also, the animal becomes poor and hide-bound. Swellings may appear in the glands of the throat; the cough becomes more aggravated, and a difficulty in breathing is noticeable. At this period severe diarrhœa sets in, and soon renders the animal weak and emaciated. As the disease is of an incurable nature, preventive measures only can be taken. All affected animals require to be isolated. No suspects should be used for breeding. Milch cows with generalised tuberculosis should be immediately destroyed, and their carcases burnt.

ULCERS.

Growths of this nature are often noticeable on station cattle, and more particularly in tropical regions where flies are usually very plentiful. This cause is usually due to an abrasion of the skin, and by means of irritation caused from flies, the part becomes severely inflamed. A growth similar to proud flesh forms and increases to an extensive ulceration.

Treatment.—When an abrasion occurs, the part requires to be healed as quickly as possible. Some agent (such as Stockholm tar) which will prevent flies from irritating the part, should be applied. In the event of an ulcer being formed, the animal should be secured, and by means of a sharp knife, the whole growth removed level with the skin. The actual cautery, or firing iron, is then to be applied generally to the whole surface, so as to form a hard crust, which should prevent a further spread of the disease.

MAMMITIS (INFLAMMATION OF THE UDDER).

One or two quarters of the udder will be noticed to increase in size and very soon become hard, and unless relief be given, an abscess will form within the vessel. Symptoms: Swelling and tenderness of the organ under pressure. It becomes hard, and the milk is watery and tinged with blood, having a tendency to curdle rapidly.

Treatment.—Bathe with warm water after each milking and afterwards rub the part well with hot lard. Should the part become hard, apply poultices and the following ointment:—Iodine, 6oz.; lard, 16oz.

This disease is generally due to exposure to cold, lying on wet ground, or may be caused by careless milking.

HORSES.

It is greatly to be deplored that this industry has not been cultivated to a greater extent, as every encouragement is offered for so doing, in that ready markets are always open for the disposal of almost every type of horse, and more particularly of the draught and remount class. Some 20 years ago we commenced exporting horses to India for remount purposes, but on account of the falling off in the supply, this trade unfortunately ceased. There is, however, no reason why it should not again be established, as the Indian Government, who for a number of years unsuccessfully attempted to supply their own requirements, have again been compelled to patronise Australian breeders. India is not the only market open to us. A very good price can always be obtained in our own State for either draughts or light horses; and these conditions will obtain for many years to come, especially in regard to the first-named. It is safe to say that at least two-thirds of this stamp of horse at present in the State have been imported during the last few years, and the demand is still increasing. The average price of a good draught horse at present is from £40 to £60, and for those of the better class still, anything up to £100. Very little seems to have been heard of the draught horse in the "early days," and it was not until the timber industry was started that a few fine specimens of the Shire horse were imported. A horse named "Farmer" and another named "Champion," which where, I believe, imported by Mr. Lennard early in the sixties, did much to improve the strain of draughts in the State. The greatest improvement, however, seems to have taken place a little later, when the late John Taylor, of Yungedine, imported from England a very fine colt of the Shire breed called "Horkstowe." This animal proved his qualities as a sire, the progeny from good mares being of a class that has very few equals in the State to-day; having good, clean, flat bone; straight and fine hair; good feet; short in the legs; well-sprung ribs; a typical draught horse from every point. The aforenamed, together with "Lochrion," imported by the late Mr. D. McPherson, of Glentromie, Victoria Plains, and "Wanderer," imported by the late Captain Faucett, of Pinjarra, are mainly responsible, with their progeny, for the upkeep of the draught stock of the State prior to about 1880, when several valuable specimens of the Clydesdale breed were imported, which have also done much to supply the ever-prevalent want. With the opening up of our goldfields and the consequent development of our agricultural resources, draught stock have become very scarce of late, and command a very high price.

There is also a great deficiency of light horses of the hack and remount stamp, and of horses suitable for spring-carts and buggies. In some manner, this is to be accounted for by the number exported to South Africa during the recent war. I understand that about 1,500 useful horses were disposed of in this manner. This drain on our resources was not an entire disadvantage, as it did much to popularise the stamina and general utility of the Australian horse. The local price for buggy horses is from £15 to £20; for saddle horses, from £8 to £15; and for spring-cart horses, from £16 to £24. This in itself should be an incentive to those who are in the position to breed horses to do so.

The most popular diseases are briefly explained and remedies suggested as under:—

CATARRH, OR COMMON COLD.

This is a diseased condition characterised by a discharge from the nostrils, which at first is more or less watery and afterwards becomes turbid. Tears flow from the eyes, a cough is present, and the animal appears dull. The causes are chiefly sudden changes in temperature, and exposure to wet and cold. The treatment, when taken in time, is simple, and consists chiefly in keeping the animal warm by means of suitable stabling and clothing. The food supply should be given in the form of hot mashes of bran and chaff. The discharge from the nostrils may be relieved by means of steaming, and should the cough prove troublesome, a mild blister of mustard may be applied externally to the throat. The fever which usually accompanies the disease will be reduced by placing from one-half to one teaspoonful of nitrate of potash (saltpetre) daily in a bucket of drinking water.

BRONCHITIS.

This is an inflammation of the mucous membrane of the bronchial tube, and frequently extends to the small bronchi. All animals are subject to this disease, but horses are more particularly liable. As a rule, it is the result of a neglected cold, and may occur spontaneously, that is, without any premonitory symptoms. Occasionally it is caused by the entrance of foreign matter, such as medicine and food into the bronchial tubes. This not infrequently happens through persons administering medicines through the nostrils instead of by the mouth. Many serious cases, the outcome of this cruel treatment, have come under my notice. The presence of this disease may easily be detected, especially in the early stages, by placing the ear to the windpipe at the lower part of the neck, when a dry wheezing sound will be heard, followed by others of a louder and moister nature. At this particular stage a discharge from the nostrils will take place and continue until the inflammation ceases, accompanied by a more or less severe cough and high fever. Good warm stabling is absolutely essential in the treatment of this disease, and great care should be taken to see that the building is properly ventilated, as pure air is an important factor. Hot

mashes should be given at each meal, and when the discharge begins, the nostrils should be well steamed, at least twice daily, until it ceases. For drinking, there should be a plentiful supply of cold water, in which has been placed a half tablespoonful of nitrate of potash (saltpetre) to the bucket twice daily for a few days. The cough may be relieved by the rubbing in of mustard to the windpipe, and also behind the shoulder, in serious cases.

CONGESTION OF THE LUNGS.

This disease is frequently associated with others, but often originates from over-exertion, this being the cause more especially with horses taken from a paddock when in good but soft condition, and put to active exercise, such as a hard day's journey in hot weather; or a dray horse may suffer in a like manner through hard pulling after having been in the stable for a lengthy period. The reason of this is apparent. The animal is made to do work which its condition renders it quite unfit for, and consequently the heart is overtaxed, and unable to propel through the system the blood, which gathers to excess in the lungs. The breathing becomes much distressed, and the animal may stop suddenly and fall down. The general symptoms are extreme difficulty in breathing, and should the animal be standing, the legs will be outstretched, and a cold sweat will break out all over the body. Seeing that the disease is due to weakness of the constitution, stimulants are to be administered, viz., sulphuric ether in 2oz. doses in a pint of water, or a bottle of ale may be given. In the event of not being able to supply any kind of stimulant, relief may be afforded by bleeding. The animal should be well cared for, and rested for a few days after the attack.

INFLAMMATION OF THE LUNGS (OR PNEUMONIA).

This is a disease in which all the textures of the lung tissue are more or less involved. As a rule it only affects one lung, and is caused by sudden chills, badly ventilated stables, and occasionally by accidents, such as a broken rib. The first signs are frequently a trembling of the muscles, dullness and loss of appetite, also disinclination to lie down. If the animal be loose it moves about in a depressed manner, taking a mouthful of food at intervals. The mouth is hot, and a cough frequently present, but if not complicated with other diseases the breathing will only slightly be disturbed.

Treatment.—If possible the animal should be placed in a well-ventilated loose-box and warmly rugged. There should be conveniently provided a supply of fresh cold water for the animal to drink, to which 10 to 15 drops of Fleming's tincture of aconite should be added twice daily until the fever has been reduced. A mustard blister should be applied to the chest immediately behind the shoulder early in the disease, and continued at intervals until recovery. The bowels are occasionally inactive, but an injection, or half-a-pint of linseed oil will be sufficient to regulate matters.

PLEURISY.

This is an inflammation of the pleuro or inner lining of the chest. This is occasionally brought about by exposure to cold, and not infrequently happens after an animal has been clipped. The symptoms are a staring coat, and coldness of the body, followed by pains similar to colic, and should the affected side be pressed firmly, great pain will be experienced by the animal. The breathing is rapid, and the abdomen has a tucked up appearance. Coughing will be frequent, and this will cause much pain. Exactly similar treatment as given for inflammation of the lungs should be followed.

GASTRITIS (OR INFLAMMATION OF THE STOMACH).

This is of rare occurrence with fully matured horses, but with young and badly fed animals it is more frequent. The cause in the horse is generally due to irritants, such as poisonous plants and medicines. The symptoms are violent pains in the abdomen, distressed and laboured breathing. Small and repeated doses of linseed oil should be given, and to relieve the pain small doses of tinc. of opium (laudanum) should be administered.

COLIC, COMMONLY KNOWN AS GRIPES.

This is a diseased condition, characterised by spasms of the intestines. It occurs in two forms, spasmodic and flatulent, the latter being the more serious. The spasmodic form is recognised by the suddenness of attack, and relief setting in after a time of excessive rolling. The flatulent form is more gradual, having no period of relief, and the bowels slowly distend with gas. The causes are various. A drink of cold water if the animal is heated ; fasting for a lengthened period; indigestible food, or sudden changes of diet. It frequently attacks horses after being turned out to grass on Sundays or holidays. If allowed out for an hour at a time during the middle of the day no harm will result, but when turned out early in the day, whilst all the moisture is on the grass, the usual consequences follow.

The treatment will depend on the cause and form. If the animal has been standing in a stable, opening medicine should be given, such as aloes in the form of a ball, eight drachms for a draught and from four to six drachms for a light horse, but in the event of the horse having been on a journey or at work, give tinc. of opium and sulphuric ether, of each one ounce in a pint of cold water. Repeat after one hour if the pain does not cease. Should a third dose be necessary, half a pint of linseed oil should be given in addition. Whisky or ale made hot, and a little ginger added, frequently gives relief, and may be confidently given when no medicine can be obtained. Supply a soft bed, and allow the animal to roll about at will. Light diet should be given for a day or two after.

ENTERITIS (OR INFLAMMATION OF THE BOWELS).

This is a most fatal disease, especially with horses, death frequently taking place within 24 hours. The first noticeable symptoms are slight uneasiness, frequent small motions of the bowels; the pain becomes steadily more severe, causing the animal to groan frequently in its agony, and giving it a tucked-up appearance, at the same time it perspires freely. The eye, at first dull, becomes bright and excited, the features wear a haggard look, the legs and ears are cold, and the body swells before death. The disease generally originates from some obstruction of the bowel, but care must be taken not to give a severe dose of opening medicine, as it only increases the inflammation without doing any good. Tincture of opium (laudanum), one to two ounces, should be given to relieve the pain. Hot fomentations should be applied to the abdomen and injections of warm water every four hours. Should the pain not cease within two hours, give linseed oil, one half-pint, with an ounce of laudanum.

IMPACTION OF THE STOMACH.

This diseased condition follows the injection of food too abundant in quantity, and greedily swallowed and imperfectly masticated. It is also due to stock being depastured for too long a period on feed of too coarse a nature. The symptoms with stable fed horses are—uneasiness, pawing with the fore feet, colicky pains, with attempts at times to vomit. This is followed by more violent pains, the body being covered with perspiration, and the face wearing an anxious expression. With grazing stock, the first noticeable signs are dullness, falling off in condition, and loss of appetite. As the disease advances, the dullness is replaced with periods of excitement, thereby showing that the brain participates in the disease. The animal's movements will show apparent blindness, causing it to wander about and get into all manner of almost impossible places and positions—death following from sheer exhaustion.

In the early stages, a full dose of physic should be given—to a horse from 4 to 8 drachms of Aloes; to cattle, one and a-half pounds of Epsom salts. In the later stages, give linseed oil one pint daily, until the bowels are regulated, also injections twice daily. Feed should consist of scalded linseed, bran, and chaff.

DIARRHŒA.

This complaint is characterised by discharge of liquid fæces, and frequently repeated. The disease is often constitional, and in such cases dieting should be the only remedy. The food supply should be small in quantity but of good quality, and given at frequent intervals. An occasional mash of linseed will be found beneficial. Irritation of the inner lining of the bowels from food or other matter is often the cause, and in such cases a dose of linseed oil to horses and of castor oil to smaller animals will generally effect a cure. When the scouring continues, one half

ounce each of laudanum, prepared chalk, and tincture of ginger as a drench once daily will afford relief.

CONGESTION OF THE LIVER.

Diseases of the liver are not of frequent occurrence amongst the lower animals, but cases of congestion, and sometimes inflammation, are met with amongst highly fed and pampered animals. Young horses when broken in, in particularly good condition, are also liable to attack. The animal will appear dull, go off its feed, but will show little or no signs of pain; lameness of the right leg is not an unfrequent symptom; yellowish appearance of the mucous membrane and white of the eye. These symptoms are usually accompanied with an attack of diarrhœa, the discharges emitting a strong odour.

Treatment.—Draw blood in early stage, and add to the drinking water, night and morning, four ounces of sulphate of magnesia. Keep the body warm and let the diet be light.

JAUNDICE.

This is a disease arising from obstructions to the passage of the bile into the intestines from disorders of the liver. The affected animal will be found to go off its feed; the surface of the tongue will have a dark brownish coating, and the mucous membrane of the eye a yellowish appearance; the fæces gives off a strong odour, and is generally covered with a quantity of mucous.

Treatment.—This is, as a rule, simple, but at times is more difficult. First give a purgative; to horses, from 4 to 8 drachms of aloes, and to cattle, one and a-half pounds of Epsom salts. To dogs give calomel and jalap, afterwards stimulants, such as chloride of ammonia, two drachms twice daily. The feed must be light and easily digestible.

NEPHRITIS (INFLAMMATION OF THE KIDNEYS).

This is a disease of rare occurrence amongst the lower animals, cows being mostly subject to it. The symptoms are tenderness of the loins, the animal stands with hind limbs apart, back arched, and the urine is highly coloured.

Treatment.—To relieve the kidneys, the bowels should be acted upon with purgative medicine. Mustard should be applied to the loins (sometimes a sheepskin will be found most serviceable), and when pain is present, a small dose of laudanum and nitrate of potash will give relief. A plentiful supply of cold water should be handy for the animal to drink.

SYSBITIS (INFLAMMATION OF THE BLADDER).

This is even rarer than inflammation of the kidneys, and is usually caused by irritants, such as frequent doses of spirits of turpentine. The symptoms are frequent inclination to pass urine

and only in small quantities, causing pain, which is noticeable by the animal lying down and getting up frequently.

Treatment.—The pain may be allayed with opium tincture, one to two ounce doses, giving afterwards bicarbonate of soda, 2 to 4 drachms twice daily in the drinking water.

ABORTION OR PREMATURE BIRTH.

This frequently results from the manner in which the animal has been fed. Any condition which quickly lowers the temperature is apt to produce abortion, such as an exceedingly cold meal early in the day, or lying on wet ground, or it may be due to a noxious smell.

Treatment.—Remove the animal from the others. Take the afterbirth away before the third day, and take care also to afterwards wash the womb with warm water to which a little carbolic acid should be added.

BIRTH OF FŒTUS.

In nearly all instances an animal gives birth to its young without assistance, but in certain instances where a breach presentation occurs, assistance is required. This should not be too hastily rendered, and only after the animal has been straining for some little time should an examination be made. The operator should first place his arm in warm water and after oiling it well gently force it into the womb. The two forelegs with the head resting between them is the natural position. These are to be secured and a noose placed around each fetlock to which a firm and gentle strain should be applied. This should have the desired effect.

BREACH PRESENTATIONS.

(1.) One or both forelegs in the passage and head turned back. Place a running noose over one or both legs as the case may be, and push them back. The head can then be secured and brought into position by fixing a hook in the eye or lower jaw and pulling upwards.

(2.) Head in passage and two forelegs back. Fix a cord on lower jaw, then press the head back and bring the two forelegs into position.

(3.) Fœtus lying on its back. Fasten a noose to the jaw and each limb, and by pulling to either side, cant it over into position.

(4.) Two hind legs coming first. Fasten a cord to each fetlock and pull steadily.

(5.) Pelvis in the passage and two hind legs carried forward. Push the buttock forward and, if possible, secure the hind legs and bring them into the passage.

A BATTLE WITH PESTS.

The following interesting report of the work done towards fighting our orchard pests with their natural enemies is taken from the San Francisco *Weekly Chronicle*, which also gives a sketch of the work done and being done by our own Government entomologist, Mr. G. Compere:—

California has been and to-day is the leader in scientific horticulture, and it is a remarkable fact that some of our most notable achievements even in really scientific work have been accomplished by men who are compelled to do their work without the authority of any university to call themselves "scientists." This is not to belittle the value of the orderly and systematic study of science as it is conducted in the schools. It is indisputable, and in those branches of science which can be carried on mainly in the laboratory it is perhaps sufficient, but whenever success depends on that intimate personal knowledge of phenomena which can come only from continual personal contact with Nature, the self-taught observer within his usually limited field is worth more than the entire staff of the Smithsonian Institution. Such men would be wonderfully helped by university training, but unfortunately it very rarely happens that to the right sort of a man there comes the opportunity for ten years' continuous study in the schools and ten years' continuous observation in the fields. Life is too short.

PREDACIOUS INSECTS.

Possibly in no one thing connected with horticulture has California so greatly distinguished herself as in the development of the art of fighting bugs with bugs. It is a distinctively Californian art, which is now finding its way into other parts of the world, and for its discovery and development California deserves and demands the sole credit. Lest our non-fruit-growing readers may not realise the importance of this art, still in its infancy, we may say, without going into particulars, that the destruction of fruit by insect pests, notably the scale insects and the codlin moth, has literally cost the State millions of dollars and is still the cause of the expenditure of hundreds of thousands of dollars annually for spraying and fumigation. By sufficient thorough work with sprays or fumigating most insect pests can be kept somewhat in check, but that is all. The only pests which we have ever actually got rid of are those which have been exterminated by their natural enemies. They have ceased to trouble us. The world has only recently come to realise the potency of the infinitely little in the operations of life and begun to learn the art—in this case wholly under the leadership of laboratory scientists—of setting good microbes to fight bad ones, as is done every day in well managed creameries. We do

not know—that is, the *Chronicle* does not know — whether in these microbe fights the good microbes devour their adversaries or only exclude them by pre-empting the food supplies, but in the California art of fighting bugs with bugs the problem is always to find an insect which does not itself harm fruit, but gets its living by devouring those which do. It is not pretended that Californians discovered the "balance of Nature," or the means by which Nature maintains that balance. That has been understood ever since mankind began to observe and think. As Dean Swift put it:

> So, naturalists observe, a flea
> Has smaller fleas that on him prey;
> And these have smaller still to bite 'em,
> And so proceed *ad infinitum.*

And that exactly describes the process. What Californians have done is merely, in the exercise of ordinary common sense, to put to practical economic use a well understood natural process which scientific men have known for ages and never thought of employing. Neither, in fact, have they ever shown much interest or any enthusiasm in its employment by others. The scientific bureau in the Department of Agriculture, whose office is to defend us from bugs, has published no bulletins on the subject, although the department has never failed in the face of actual accomplishment by others to claim the credit for what others have done. There is an instance of this in the last report of the Secretary of Agriculture.

THE THEORY OF THE WORK.

The theory is very simple. No insect is a pest in its native land, because when Nature originates a pest she invariably invents a parasite to keep it in check. It continually happens, however, that man in taking fruits and plants from one part of the world to another carries with it the pest without the parasite. As these low forms of life multiply with inconceivable rapidity when unchecked, the injury soon becomes enormous. The problem then is to discover the country of the origin of the pest and go there and find the parasite which keeps it down. Import the parasite, breed it and turn it loose, and the parasite does the rest. With plenty of natural food it thrives mightily, until the pest disappears or ceases to be of economic importance.

DEVELOPMENT OF THE ART.

The story of the development of this art in California is very interesting. Twenty-five years ago, more or less, one of the wonders of Southern California was the Wolfskill orange grove of 40 acres, of which some decaying stumps may even yet be visible in vacant lots in the city of Los Angeles. The manager of this orchard was Alexander Craw, now and for many years past horticultural quarantine officer of this State. He might or might not have got some smattering of entomology in his school days, but he came to

have a most intimate and unfavourable knowledge of some species of insects from daily observation of their ravages in his orange trees.

The art of spraying was then in its infancy, and fumigation with poisonous gases had not been thought of. The pests were having their own way and destroying the fruit and the trees. Chief among these pests at that time was the *Icerya purchasi*, or cottony cushion scale. This had been imported on some orange trees from Australia in 1868, and in the eighties threatened to completely destroy the orange industry in this State. Mr. Craw discovered that it was not a pest in Australia, and wondered why. By correspondence, he satisfied himself that it was kept down by a parasite, and he wished he had some. He brought the matter to the attention of Elwood Cooper, then and ever since, until appointed sole commissioner, president of the State Board of Horticulture. Not being an entomologist, and so hampered by the traditions of science, Mr. Cooper's common sense had nothing to impede its activity, and he promptly agreed with Mr. Craw that we ought to have that parasite. As president of the State Board of Horticulture, Mr. Cooper sought to interest Dr. C. V. Riley, then chief entomologist of the Department of Agriculture, and induce him to send for the insect. He would have nothing to do with it. The proposition was apparently doubly obnoxious in that the proposer was no "scientist," and, more than that, did not belong to his "bureau."

OFFICIAL INDIFFERENCE.

It is virtually an unknown occurrence for any bureau official in this or any other country to take the least interest in any proposition which does not originate in his bureau. But Mr. Cooper and Mr. Craw were determined to have the parasite, but they knew that they could no more get the money from the California Legislature than from Dr. Riley. It happened that there was an international exposition in Australia, in which this country was participating in a small way, and to which the late Frank McCoppin of this State was commissioner. In conversation with some of our Southern fruit-growers, Mr. McCoppin expressed his desire to be useful to our fruit interests in any way possible while in Australia, whereupon he was promptly requested to send us the parasite of the cottony cushion scale. To this Mr. McCoppin replied that he knew very little about horticulture, and nothing about bugs, and feared the job was beyond him.

Then it was suggested that he take a competent man with him for the purpose. Mr. McCoppin could hardly see his way, but finally concluded that he could find money to pay the expenses if the department could pay the salary. There was then in the employ of the department, as a collector of specimens, Albert Koebele, then and now a citizen of Alameda county. Mr. Koebele was not a "scientist," but had acquired a practical knowledge of insects in field work. Mr. Cooper telegraphed Dr. Riley, stating Mr. McCoppin's offer and asking him to let Mr. Koebele go.

Dr. Riley refused—had no money for the purpose. Then Mr. Cooper went over Dr. Riley's head, and telegraphed the whole situation to Secretary of Agriculture, Jeremiah Rusk. Happily, Secretary Rusk was not a scientist of any kind, unless it was political science, and he promptly ordered Dr. Riley to send a man with Mr. McCoppin, and Mr. Koebele went. He found, as was expected, the scale in Australia, but in very small numbers and doing no appreciable damage. As soon as he found the scale he found the parasite upon it—the *Vedalia cardinalis*—which was at once sent to this State and placed in the Wolfskill orchard. As soon as it could be bred in sufficient numbers, colonies were turned loose in the infested groves, and were a howling success from the first day. Within two or three years the cottony cushion scale was virtually exterminated, and is not now even thought of as a pest. In fact, it is with difficulty that the Commissioner of Horticulture can find enough to keep a colony of the *vedalia* alive for use when the scale gets a fresh start in some locality.

The marvellous success of the *vedalia* was, of course, claimed by the Department of Agriculture as one of its gifts to the country, but the department entomologists showed no disposition to follow the lead up. Mr. Koebele, however, was employed by our own State Board of Horticulture to seek parasites for other pests, in the firm belief that with a little effort all our fruit pests could be got rid of as promptly as the cottony cushion scale. Experience has shown, however, that this, as well as other arts, is long. Many parasites have been sent into the State, some of which have failed to establish themselves; some, like the *Rhizobius ventralis*, a parasite of the widespread and very destructive black scale, have succeeded in some parts of the State and failed in others, presumably owing to unfavourable climatic conditions. A number of valuable parasites have been introduced by accident, as the pests were introduced. Among these is the *Comys fusca*, a parasite of the brown apricot scale, which Commissioner E. M. Ehrhorn found in Santa Clara county, and which is exterminating a once very serious pest infecting many varieties of fruit. Mr. Ehrhorn also obtained from South Africa the *Scutellista cyanea*, which is evidently to make good the deficiencies of the *rhizobius* in destroying the black scale. Mr. Ehrhorn's attention was directed to South Africa from a passage in a report of the entomolgist of Cape Colony, which showed that the black scale was there, but not a pest, being kept in check by a parasite. With great difficulty a few specimens of the parasite were obtained by Mr. Ehrhorn and bred by Mr. Craw, and it is proving completely successful, breeding, as it does, so rapidly that the scale has no chance whatever.

PROSECUTION OF THE WORK.

Mr. Koebele remained in the employ of the board until the Government of Hawaii offered him a larger salary than we could afford, and he has been in that employ ever since. After losing Mr. Koebele the State Board employed George Compere, who, although

entirely self-educated, had developed considerable ability as a horticultural inspector in Los Angeles county. Mr. Compere's most important service while in our employ was finding a parasite of the red scale. Mr. Compere found this parasite in China, which is the home office of this celebrated scale. It exists there and is not a pest, and the story of the discovery of the pest and its parasite on a small orange tree in a garden, the purchase of the entire outfit for $1, and the shipment of the tree with the live stock on it, was all widely published at the time of the occurrence. The owner of the orchard in which this parasite—as yet unnamed—was placed destroyed the trees and the parasite with them, but from such of its work as has been seen no doubt is felt as to its ultimate success. The San José scale is no longer a serious pest in this State and is being gradually exterminated by parasites, some of which are native species, which have acquired a taste for this kind of scale meat. Soon after this trip to China Mr. Compere was engaged by the Colony of West Australia, in whose service he now is, this entire industry, in fact, being directed by Californians.

RESULTS THUS FAR ACCOMPLISHED.

The scales actually got rid of to date—not exterminated, they are never exterminated—but which have ceased to be the cause of serious injury or expense, are, so far as known to the writer:

In California—

- The cottony cushion scale.
- The black scale (not gone, but going fast).
- The brown apricot scale.
- The San José scale.
- The soft brown scale.
- The yellow scale.

In Hawaii—

- The red wax scale—an omnivorous feeder.
- Certain "mealy bugs" on coffee plants.
- Lantana, a destructive plant, the parasite destroying the seeds.
- The cabbage butterfly.

In West Australia—

- A cabbage moth.
- The soft brown scale.
- Mealy bugs.
- A grape scale—not not known here.
- Black scale.

It is useless in an article like this to give the names of the different parasites. They are all very hard names and are better skipped. Some of the names are not yet known. Messrs. Koebele and Compere, who thus far have nearly a monopoly of the practice of this art, are not learned entomologists. They do know very intimately the pests for which they seek remedies, and can see

through a microscope. When they find something eating the pest they do not wait to be introduced, but seize upon him and send him home. If he is not recognised there, a specimen is sent to the entomologists at Washington, to be identified and labelled, which can be done there with neatness and despatch. The entomologists know bugs when they see them, even if they do not always know how to make the best use of them.

GREAT PECUNIARY GAIN.

The pecuniary value of the work accomplished here and elsewhere to date by the labours of Messrs. Cooper, Craw, Koebele, Compere, and Ehrhorn cannot even be guessed at. It is quite within bounds to say that $5,000,000 would not pay the fruit-growers for being set back where they were and compelled to fight these pests with sprays, and, in addition, to the spraying and fumigation which they still have to do for pests for which no parasites have been found, and the accomplishment is due solely to the abiding faith of Mr. Craw and Mr. Cooper in the effectiveness of the processes of Nature and the bulldog tenacity with which Mr. Cooper has employed his official position to prosecute the work, regardless of difficulties or the lack of faith and interest in scientific circles; and, with the exception of Mr. Cooper, all those who have done this work were poor men when they began and are poor men still.

THE STORY OF ONE HUNT.

Some idea of the difficulties involved in this work may be got from some experience of Mr. Compere in the quest in which he is now engaged. In West Australia they have a destructive fruit fly which infests a large variety of fruits. The fruit flies are the worst pests there are. By sheer luck for a long time, and by a most vigourous quarantine in recent years, California is free from them. The fruit flies deposit their eggs in the fruit, leaving no visible sign, and the eggs hatch into maggots, which fill the pulp of the fruit. They cannot be reached by sprays or fumigation. It is parasites or nothing. In West Australia they heard that the same fly was found in Spain. So Mr. Compere went to Spain, hardly expecting to find a parasite, but grasping at a straw. As he expected, he found sections where fruit culture had been given up by reason of the pest, but he found no parasite. On his way home he stopped in Washington to see if the department entomologists could give him useful information. They said they could not. He asked to see their note books containing material not published, which they were glad to show him. On referring to his index the entomologist in charge of that division found in the first reference to which he opened allusion to a letter from a gentleman from Sao Paulo, Brazil, inclosing a specimen of the insect to be identified, and adding a particular request that the specimen be returned. "Why so?" thought Mr. Compere. If they were plentiful there he could catch a specimen with much less trouble than to have it sent back, and yet the insect was certainly there. So Mr. Compere took the

address, wrote to the gentleman and went home. The clue did not justify him in going to Brazil without instructions. For six months no reply came to his letter, and so Mr. Compere started for India after a parasite for something else. He found several parasites, but could by no means get them out, as bubonic plague was raging, and everything shipped by mail or otherwise had to be fumigated, and fumigation, which will kill plague microbes, will also kill insects; but while there he received the long-expected letter from Brazil, which informed him that the fruit fly had been known to the gentleman as long as he had been in the country, but it was "rare."

If the fly was rare in the very paradise of insect life, Mr. Compere was convinced that it was the work of a parasite, and he immediately started for Brazil, passing through this city a few days ago, confidently expecting to find the bug he needs. Possibly it is not surprising that our Washington authorities hesitate to use public funds in prosecuting quests so uncertain. Two trips across the Pacific, the American Continent, and the Atlantic and back in search of an insect which is probable hardly visible when found, and which may not be found at all, is risky business. As more people get into the business in different countries and discoveries are exchanged the practice of the art will grow cheaper.

PESTS AWAITING PARASITES.

While in Spain, Mr. Compere found a parasite of the codlin moth, which he believes will be effective. That would be almost too good news to be true. The codlin moth is one of the most destructive of all pests, and is widely distributed. It probably, however, does more damage in California than anywhere else, and is not known to have any parasite here. A search in some country where it exists but does no great harm may result in delivering us from its ravages. It is not unlikely that Mr. Compere may be sent to look further into the character of this Spanish parasite. There are other great problems awaiting solution. The State of Massachusetts has spent hundreds of thousands of dollars in vain attempts to exterminate the gipsy moth, which was introduced from Europe. Like the cottony cushion scale, it is a general devastator, and Massachusetts has bought and paid for entire orchards and forests which have been completely burned up, and while of course the progress of the moth has been checked, yet it is plain that it will soon be as abundant as ever, and Massachusetts is appealing to Congress for help, lest it consume the whole country.

It is no such pest in Europe, and Mr. Compere feels perfectly sure that within two years parasites could be found which would entirely subdue it. The same belief is held with regard to the cotton boll weevil, which threatens the entire destruction of our cotton industry, and for whose extermination Congress recently appropriated half a million dollars. And yet the Government entomologists give virtually no hope of subduing it, for its life

history is such that there is no way of reaching it by artificial means. Somewhere it exists and is not a pest. The problem is to find that place and find the parasite. If our bureaucratic entomologists have ever proposed such a thing we do not know it, which is astonishing in the light of the enormous savings which have unquestionably been made by these methods by Californians. It is a California art, and these sufferers will apparently be compelled to call on California for help. Parasites have not yet relieved us from spraying and fumigation, and perhaps never will, for new pests are constantly introduced. There are also occasionally conflicts, apparently inevitable, when parasites are partly introduced and yet spraying is continued, the spraying, of course, killing parasites with all other insect life. Nevertheless, it remains true that only through Nature's methods is there any hope whatever of maintaining the balance of Nature which is essential to the prosperity of our race.

BEE NOTES.

UNFINISHED SECTIONS.

It is quite a problem with some, especially amateur bee-keepers, how best to use the unfinished sections. They have, of course, no market value; that is, they cannot be sold through regular channels. Therefore, it is seldom possible to realise for them their real value. Although the honey they contain may be of an excellent quality, they are so unsightly that few people care to buy them, even for a very low price. This being true, the prudent bee-keeper naturally tries to find a better method of utilising this unfinished product of the apiary.

Of course, a large number of those best filled may be used on the home table, yet there are often more than can be consumed by the apiarist's own family. Then, too, there are always some that, although nearly full of comb, contain very little honey, while others may be just started. It is of these last two kinds that I would speak particularly.

One bee-keeper of whom I know solves the problem of utilising his imperfect and unfinished sections by cutting out all that contains honey and dropping them all together into a large jar. This "hash," as he calls it, is reserved for home use or sold to the neighbours by the pound. At first sight this mixed honey and comb does not look inviting, yet as a matter of fact it is greatly relished by the family and all others who eat it.

Although this practice is commendable for damaged and unsaleable sections that are practically full, it is better to use the others in some way which will admit of saving the comb for

another season's use. There are two ways of doing this: First, by uncapping and extracting the honey; the second, by feeding the honey they contain to light colonies. The first I have never done, and under ordinary circumstances I would not advise it. The second method is practical and advisable. If the saleable sections are sorted out as the supers are removed from the hives, it is the better way to place those that are still unfinished in another super, and set them over some colony that is short of stores. If the bees do not carry the honey down at once they will do so later before they go into winter quarters. The empty combs should then be removed and stored in some safe, dry place, where they will not be damaged by mice and dust.

If, when putting the colonies into shape for winter, any may have been overlooked and is later found to be short of stores, a super or two of these partially filled sections will be sufficient to save the bees, and may be given them at any time. Then, again, these sections may be given to the lighter colonies in the spring to prevent spring dwindling, although it is far better to put them on in the fall and thus prevent the need of them in the spring. Moreover, the honey in unseated cells is liable to candy, and so become useless for feeding. Therefore, it is not advisable to save them for this purpose.

The advantages of having ready drawn combs to give the bees at the beginning of the honey flow are many and manifest. Many colonies in every apiary are slow to begin work in the sections unless they are encouraged to do so by having combs all ready to receive their honey. For this reason we always put a number of sections containing empty comb in every super.

It is estimated that from seven to eleven pounds of honey are required to produce one pound of wax, from which one pound of comb is evidently worth from seven to eleven pounds of honey; yet, as a matter of fact, the comb has a still greater value since the time required to manufacture it is valuable at the time when it is needed for storing super honey. For these good reasons all prudent beekeepers save and preserve their empty combs for further use.

The only objection to using old combs in the sections is that such combs become slightly yellowed and honey stored in them does not look quite so tempting as that stored in fresh new combs. Especially is this true if such combs were built during the time when dark coloured honey was being gathered. This slight discolouration of the honey is not usually sufficient to detract from its marketable value to any great extent, and, therefore, this objection is not a serious one.

To prevent the section boxes from warping and becoming discoloured they should be left in the supers and stored in some dry, clean place in an upper room if possible. Managed in this way both combs and boxes will be in good condition when wanted for use again.

BEE-KEEPING FOR SMALL FARMERS.

By W. BROUGHTON CARR, Editor *British Bee Journal*.

ON THE ADVANTAGES OF BEE-KEEPING.

Our own impression is that if the possibilities of what can be done with a few hives of bees are stated reasonably, in plain terms, without any exaggeration, and proved by facts and figures, we shall have not a few small farmers who include bee-keeping in their ordinary work, and find it the most profitable branch of the farm.

But, in marshalling our facts, we must begin by stating two indispensable conditions, failing which success is impossible. These are:—First, a suitable location; and, second, some natural aptitude for bee-management on the part of the farmer himself.

Regarding our first proposition, the adage about "taking coals to Newcastle" may be reversed by saying "it is no use starting to keep bees with the view of profit in a district where no bee-forage is grown." Not only so, but the *quality* of honey yielded by the nectar of the flowers from which the main supply is harvested is an important factor in the question. In other words, there are many counties and districts in this State, where, in an ordinary season, the honey is of such excellence as to bring the highest price of the year; while in other parts, though a plentiful yield is secured, the produce is so inferior in quality as to be hardly saleable for table use.

It must also be borne in mind that the main honey crop is gathered from fields, fruit orchards, and heather hills; all other sources of supply, including flowers grown in gardens, are merely subsidiary to the above, and need not be taken into account at all by the bee-farmer.

The second condition is no less important than the first, viz., a natural aptitude for bee-work. Some men are totally unfitted by nature and temperament for bee-keeping, and for such it is mere waste of time trying to learn. The good bee-man is somewhat akin to the bees themselves, in being cleanly and orderly. He must also be quiet and gentle when manipulating hives, as anything like rough handling is soon resented by the bees; while the man whose habit is to "bang things about"—to use a homely phrase—will soon find out his mistake, and this is the one to whom the above deprecatory remarks apply.

On the other hand, if our small farmer possesses in any degree the necessary natural aptitude, he will have no difficulty in master-

ing the few essentials required to make a successful bee-keeper; but he must begin aright by acquiring some elementary knowledge of the natural history of the honey-bee, in order to arrive at the "why and wherefore" of the "happenings" which occur in the various stages of bee-life. He must learn the difference in value between strong colonies and weak ones, and the number of bees (approximately) required to make up the former, together with the conditions implied in what is termed "a prosperous brood-nest." Then, and closely connected with the latter, comes the supreme importance of having his stocks headed by young, vigorous, and prolific queens, because the queen—or mother-bee—alone lays the eggs from which the whole population of the hive is produced and maintained. These details, together with a few particulars connected with the several phases of bee-life (from egg to perfect insect), and the time occupied in each stage, can be acquired by any intelligent man who devotes an hour's reading to the subject. Roughly speaking, the metamorphosis of the worker-bee may be stated in a few words, as follows:—The egg hatches in three days; the larva is then nursed and fed for about five days, when feeding ceases, and the cell containing the larva or grub (now in the nymph stage) is sealed or capped over, and it remains so till the twenty-first day, when it emerges a perfect bee. Drones mature in twenty-four, and queens in from fourteen to seventeen days. The duration of the worker-bee's life is measured less by length of days than by the amount of labour done. In the busy gathering time of summer the insect is worn out and dies after about six weeks of toil; but bees born in autumn, after the gathering season is over, will live more than as many months. In fact they form the field-foragers in early spring of the following year.

In closing this part of the subject, and prior to dealing with the practical work of an apiary, it must be understood that a good text-book on bee-keeping is indispensable. The scientific side of apiculture, though full of interest to those whose taste or inclination lies that way, may be put aside, except so far as acquiring a brief but sufficient knowledge of the few diseases bees are subject to. The most suitable work for the purpose we know of is *The British Bee-Keepers' Guide Book*, by T. W. Cowan. This little manual, costing 1s. 6d., contains everything the bee-keeper requires to know. It is written in simple concise language, with no superfluous verbiage, and illustrated with numerous engravings explanatory of the text, so that its teachings can be understood and carried out by anyone possessing ordinary intelligence.

(To be continued.)

DALGETY'S REPORT.

STOCK AND STATION MARKET.

Messrs. Dalgety and Co., Ltd., York, report:—

We held our usual monthly stock sales at Narrogin on May 18, Beverley on May 26, Katanning on May 20, and a special sale of stock at Northam on May 25. At each of these sales the yardings were somewhat light, owing to the heavy rains on these days. At Narrogin we sold a line of 415 ewes at an average of 17s. 7d. Heavy draught horses sold readily at from £35 to £40; medium draughts, from £20 to £30. At Katanning there was a very fair yarding of stock and a representative attendance, when we sold store steers to £10 12s. 6d.; springers, to £8; milch cows, to £13; heavy draught horses, to £40; medium draught horses, from £25 to £35; light harness horses, to £18. Fowls sold readily up to 4s. 8d. per pair; ducks, to 7s. 2d. per pair. At Beverley we sold light harness horses at up to £18; no demand for heavy draughts. Porkers found a ready market at from 28s. to 34s., and a specially good line at up to £2; slips, up to 11s. 6d. There was a good demand for poultry, and all lines sold readily: roosters to 5s. 7d. per pair; hens, to 4s. 9d. per pair; ducks, to 6s. 3d. per pair; and a specially good line of Minorcas at £1 per pair. At Northam we sold a good line of mixed cattle at an average of £8 per head, and porkers realised up to 31s. 6d.; slips, to 15s. 6d.

MONTHLY REPORT, FREMANTLE.

HIDES, SKINS, TALLOW, ETC.

Sheepskins.—Supplies have gradually increased during the past month some good catalogues being submitted, spirited competition ruling throughout, a ready clearance being made of all offerings. Values have steadily improved in sympathy with the good reports from the London market, and are now fully ½d. per lb. higher than those ruling a month ago.

Good Merino, ¾ to full wool	6¾d. to 7⅛d.
Medium " "	6d. to 6⅜d.
Good, ¼ to ½ "	6d. to 6½d.
Medium " "	5¼d. to 5¾d.
Fine Crossbred ¾ wool	6½d. to 6⅞d.
" " ½ "	6d. to 6½d.
Medium " ½ to ¾ wool	6d. to 6⅝d.
Coarse " "	5½d. to 6d.
Pelts	4¼d. to 4¾d.

In all cases where pelts of above are sundried, weevil eaten, torn, or perished, prices are from 1d. to 2d. below quotations.

Hides.—This market has been well supplied, and although prices only admit of slight alteration, competition has been very dull, specially for medium weights, and all lines in wet and sloppy condition.

Heavies	5d. to 5½d.
Medium	4½d. to 4¾d.
Light	4¼d. to 4⅝d.
" dirty, wet, and inferior	3⅞d.
Dry	4½d. to 5½d.
Damaged	3d. to 4d.

Kangaroo and Furred Skins.—Increased supplies to hand, and all in fresh and clean condition have sold readily at improving values. Many lots forward had unfortunately been badly damaged by shot, this fault causing a considerable depreciation in their value. Opossum skins are beginning to

arrive freely, but owing to the unsatisfactory results of the last London sales prices are considerably less than the extreme values of last season.

Kangaroo Skins—

	Blue Skins.	Red Skins.
¾ to 1lb. average ...	2s. 4d. to 2s. 6d. ...	2s. 2d. to 2s. 5d.
½lb. average ...	1s. 6d. to 1s. 9d. ...	1s. 6d. to 1s. 9d.
1½ to 2lb. average ...	1s. 10d. to 2s. 1d. ...	1s. 9d. to 2s.
Damaged lines ...	9d. to 1s. 6d. ...	9d. to 1s. 3d.
Euro skins, from ...	1s. to 1s. 5d.	

Opossum Skins—

Good greys and reds ...	5s. to. 6s. per dozen average
Medium „ ...	4s. to 5s. „ „
Mountains	15s. to 16s. „ „

Tallow.—Our sales have consisted chiefly of broken packages, tins, and oddments, and these have been readily taken by the local soap and candle makers at values showing no alteration. Shipping parcels have, in sympathy with the London and Eastern markets, fallen from 1s. to 1s. 6d. per cwt.:—

Prime (in casks)	... 21s. per cwt.
Medium mixed (in casks)	... 19s. to 19s. 6d.
„ „ tins and oddments	... 17s. 6d. to 18s. per cwt.

Horns, Hair, etc.—We have made a satisfactory clearance of several good lines during the month, and there is a keen demand for all descriptions.

Horn, large and fresh, to ...	35s. 6d. per one hundred.
„ small „ „ ...	12s. 6d. „ „
„ stale and perished ...	5s. per one hundred.
„ very small	1s. „ „
Rough bones	£3 10s. per ton.
Horse hair	1s. 2½d. per lb.
Cow hair	6d. per lb.

WEEKLY REPORT.

Messrs. Dalgety & Company, Limited, wool and produce brokers, Perth, Fremantle, and Kalgoorlie, report as follows for the week ended 8th June, 1904:—

Wheat.—Latest "London" cables indicate a quieter marker for wheat, buyers operating very cautiously. Australian wheat is selling at from 29s. to 29s. 6d. per quarter of 480lbs., c.i.f., whilst local wheat is quoting at Northam at 3s., f.o.r. On the basis of the above prices, wheat shipped to London would realise a shade over 2s. 5d. per bushel, f.o.r., Northam.

The local market shows no sign of an improvement, there being only a limited inquiry, whilst considerable quantities of wheat are still in farmers' hands. Perth and Fremantle offer sale for limited quantities, the market fluctuating from 3s. 3d. to 3s. 5d. per bushel, just according to the supplies forward. Smutty samples are worth 3s. 2½d. per bushel.

Algerian Oats.—Very few Algerian oats are coming forward, and it is estimated that only limited quantities are now in farmers' hands. Local oats are in particularly good demand just now, they being much superior to the best imported lines. During the week we have been unable to fulfil buyers' requirements for local oats, and we had recourse to importations from the other States. Local Algerians are selling at Perth at from 2s. 4d. to 2s. 6½d. per bushel. *Seed* Algerians are also in fair demand, and we sold several small lines at full market rates. Stout white oats are also selling in small parcels for seed, and we placed very prime samples at up to 3s. per bushel. Algerian oats have to a large extent replaced "New Zealands" on our market, and importations from New Zealand show a great decrease, Melbourne market supplying the deficiency.

Barley.—Very little local barley is now in farmers' hands, the bulk of the business being confined to importations of South Australian samples. We sold one (1) truck of local barley at 3s. 1d. per bushel. English barley grown in South Australia is selling in fair quantities at from 3s. 5d. to 3s. 9d. per bushel, according to sample.

Skinless Barley is still in good demand at 4s. per bushel.

Chaff.—Supplies are coming forward very slowly. Last week the restricted arrivals enabled us to further realise upon chaff, which we had stored on account of various farmers at Perth and Fremantle earlier in the season. Our Perth stocks have now been cleared, whilst at Fremantle our holdings of chaff amount to about 100 tons.

All lots submitted for auction meet with good competition at market rates, but there is a slightly weaker undertone noticeable, but of course, with a continuance of the prevailing wet weather, the light arrivals would force buyers to pay higher prices. However, any improvement would be a signal for a renewal of consignments, much chaff being still held by private speculators. The following rates are obtainable at Perth and Fremantle:—

Prime, green wheaten, £4 5s. per ton.
Good quality wheaten, from £3 10s., £3 15s., and £4 per ton.
Medium wheaten, from £3 to £3 7s. 6d. per ton.
Prime green oaten.—None forward. (Good demand.)
Good quality oaten, from £3 5s. to £3 15s. per ton.
Inferior samples of wheaten from £2 per ton upwards.

Both Perth and Fremantle markets are in a position to absorb more consignments, particularly at Fremantle, as the recent arrivals during the past week have been the lightest on record for many months. Last week we reported that a continuance of the then prevailing dry weather would keep growing feed back; however, the more recent rains will prove good growing weather, and this will in all probability be reflected in prices.

Hay.—Pressed hay for stock feed remains unchanged, and we have effected sales at from £3 10s. to £4 10s. per ton, according to quality, and we have also sold one truck of extra prime oaten hay at £4 17s. 6d. per ton, Fremantle. The market is quiet, only a limited amount of business being transacted.

Pressed Straw.—Consignments to Perth and Fremantle have been light, consequently there has been a slightly improved demand at £2 per ton. However, straw is not universally used in Perth and Fremantle, and these markets are only capable of absorbing a very limited quantity.

GARDEN NOTES FOR JULY.

By PERCY G. WICKEN.

Although July is generally the coldest and wettest month of the year, still in most well-kept gardens a fair supply of winter vegetables are available. The splendid light showers experienced during May gave a splendid start to the early-sown vegetables, and those who took advantage of the early rains experienced at the end of March should now be rewarded with a good supply of vegetables. To produce good quickly-grown vegetables the ground requires to be supplied with a good heavy dressing of manure, not a few

pounds per acre drilled in as we do in the farm for the production of cereal crops, but a good liberal dressing of, say, from 5 to 10 cwt. of bonedust per acre, well dug in and thoroughly mixed with the soil. An acre of land covers 4,840 square yards, and to supply a dressing of bonedust at the rate of half-a-ton (1,120 lbs.) per acre, we find that it works out to about 3 ozs. per square yard; not a heavy dressing when we come to look at it in this light. Also, when writing about stable manure and recommending gardeners to apply at the rate of 20 tons to the acre, this seems an enormous amount to the amateur gardener, but when we reduce it to figures we find that the quantity is not great, and only works out to about 6 lbs. per square yard, or about a good-sized shovelful. Take 6 lbs. of stable manure for yourselves, and spread it over a square yard in the garden, and you will find 20 tons per acre is not such a heavy dressing. If the ground becomes very wet, plough-furrows or trenches should be made to carry off the surface water, while a system of underground tile drains will prove a great benefit to a garden, as a well-drained soil is much warmer than a badly-drained one, and the plants therefore mature earlier; and the earlier vegetables are the most welcome for home use, and the most profitable for market.

ARTICHOKES (Globe) may be planted out this month. They are propagated by planting the suckers from old plants or rooted plants from the beds. In rich soil they grow to a great size, and require to be planted about 3ft. apart each way.

ARTICHOKES (Jerusalem).—These are different to the Globe artichoke, and produce tubers, somewhat in the same manner as the potato plant, and they are cultivated much in the same way. They belong to the same tribe as the sunflower plant, and when the plants are in flower they look like bushes of dwarf sunflowers. The land should be prepared ready for sowing, and at the end of the month they may be sown in the warmer districts.

ASPARAGUS.—In the warmer districts the roots can be planted out in the trenches made as already described, but in most parts the beds had better be prepared ready for planting out next month.

BEANS (Broad) should now be bearing in most localities. A few more rows may be sown to keep up a supply.

CABBAGE.—Plant out as many plants as you have room for, and sow seed of a summer variety, to plant out later on. They should be planted out in rows three feet apart, and about two feet apart in the rows. All weeds should be kept hoed down between the plants.

CARROTS.—Those already up will require thinning out, and a few more rows of seed may be planted for future use, or the plants thinned out from the rows already up may be transplanted into other rows, if sufficient care is exercised in the planting.

CAULIFLOWERS.—Plant out any plants that are available, and in the moister districts a further supply of seed may be sown.

CUCUMBERS.—In the warmer coastal districts beds may be prepared for this crop, and towards the end of the month seed may be sown. They are best planted in a hot-bed in a sheltered position, or under glass, and will require to be covered at night.

LEEKS.—Any strong young plants on hand may be planted out in trenches previously well manured, and a further supply of seed may be sown.

LETTUCE.—Plant out all the young seedlings you have, and sow a further supply of seed for future use.

ONIONS can still be freely sown — either in beds for transplanting later on, or in rows in the field—and thin out when they come up. Special attention must be given to weeding the young plants, and the ground requires to be brought to a fine tilth.

PEASE.—Sow largely of this favourite vegetable. Plant in rows three feet apart, so as to enable the horse hoes to be worked between the rows, as by this means a lot of hard labour is saved. There are a large number of varieties obtainable, but the Yorkshire Hero is one of the best. Other varieties are Telephone, Stratagem, and Veitch's Perfection (of the tall-growing variety), and McLean's Little Gem, and American Wonder (of the dwarf varieties).

POTATOES.—In the coastal districts small crops may be sown this month. Inland, the ground can be prepared for sowing early next month.

TOMATOES.—A few plants can be planted under glass, or in boxes which can be taken inside at night, so as to raise a few plants for early planting.

TURNIPS.—Those already up will require thinning out, so as to allow those left in the ground to develop to a greater size. A few more rows may be sown to keep up a supply.

FARM.—July may be said to be one of the slackest times of the year on the farm; the days are short, and the weather generally unfavourable. The cereal crops should be all sown and well above ground. If the land is not too wet, the crops will be improved by a good rolling, this will also help to make the reaper and binders run over the ground better at harvest time. If, after rain, stagnant water lies about in any of the hollows, a few plough-furrows should be made to carry the water off.

A small area of rape or mustard may still be sown, if not already in, but it will not give as good results as that sown earlier.

Towards the end of the month land may be prepared to sow lucerne, but for this purpose it requires to be worked up to a fine tilth, and to be free from weeds, as the young plants require the full use of the ground until their roots begin to penetrate the soil. During any wet weather—of which we are likely to have a fair share at the present time—opportunities should be taken to repair all harness and implements, so that time need not be taken for this

purpose in fine weather. As soon as the seed-drills have finished sowing the crops they should be cleaned out, and all particles of manure removed from the manure-box, as these cause the parts to rust. All parts should be given a coating of oil, and the numbers taken of any parts which are at all worn, so that duplicates may be obtained to replace them for next season.

THE CLIMATE OF WESTERN AUSTRALIA DURING MAY, 1904.

The month was, on the whole, fairly seasonable—perhaps a trifle more wintery than usual. The barometers were about normal, but the temperature slightly below the average for previous years, especially all along the West Coast. There was one severe storm of the usual winter type, which occurred on the 14th; but it was fortunately of short duration. The barometer reached a minimum at Perth of 29·62 at 4 a.m., and at Cape Leeuwin of 29·41 at 8 a.m., and then rose very rapidly. The wind attained a maximum velocity of 45 miles per hour in Perth, and 56 at Cape Leeuwin. No serious damage was reported, but a number of small craft were blown ashore. The barometer had risen to 30·28 at Perth by 9 a.m. on the 15th, and remained fairly high for some time; the month closing with a well-established anticyclone over the South-West corner of the continent, and cold fresh weather, with frosts inland.

On the whole, the rainfall was about the same as the average for previous years, except over the Coolgardie and Murchison fields and the far North, where it was heavier than usual.

The following figures show the mean and absolute minimum temperatures on the surface of the ground, from which it will be seen that frosts have now fairly set in:—

	Mean.	Lowest.	Date.
Peak Hill	48·0	32·0	28
Cue	44·8	32·0	26
Coolgardie	41·7	25·8	28
Southern Cross	38·8	21·0	28
Walebing	37·1	25·2	28
York	42·8	32·0	30, 31
Perth Observatory	45·9	36·1	16
Wandering	34·5	20·0	28
Katanning	38·0	27·0	31
Bridgetown	39·3	25·5	30
Karridale	43·0	29·2	29

The Climate of Western Australia during May, 1904.

Locality.	Barometer (corrected and reduced to sea-level).				Shade Temperatures.									Rainfall.	
	Mean of 9 a.m. and 3 p.m.	Average for previous years.	Highest for Month.	Lowest for Month.	May, 1904. Mean Max.	May, 1904. Mean Min.	May, 1904. Mean of Month.	May, 1904. Highest Max.	May, 1904. Lowest Min.	Average for previous Years. Mean Max.	Average for previous Years. Mean Min.	Average for previous Years. Highest ever recorded.	Average for previous Years. Lowest ever recorded.	Points (100 to inch) in Month.	Total Points since Jan. 1.
North-West and North Coast:															
Wyndham ...	29·958	29·984	30·117	29·757	87·1	70·7	78·9	95·0	59·6	90·5	71·4	100·4	58·0	30	2904
Derby ...	29·965	29·990	30·084	29·797	89·3	62·6	76·0	94·6	54·2	89·6	63·7	98·8	46·0	7	3130
Broome ...	29·968	29·996	30·141	29·811	85·5	64·9	75·2	94·0	54·5	87·9	62·5	97·3	46·4	108	2107
Condon ...	30·004	30·036	30·225	29·814	82·5	60·1	71·3	90·0	42·0	82·2	56·8	98·0	42·0	24	237
Cossack ...	30·010	30·044	30·235	29·908	83·6	63·6	73·6	93·5	49·0	83·1	62·4	96·5	51·0	106	346
Onslow ...	30·065	30·036	30·270	29·900	81·0	57·0	69·0	92·0	42·0	83·6	59·5	95·0	45·2	306	477
Carnarvon ...	...	30·070	30·316	29·825	74·9	56·0	65·4	88·4	43·0	79·4	57·3	91·3	43·0	43	203
Hamelin Pool...	30·097	30·080	30·384	...	74·2	52·9	63·6	86·0	42·2	77·1	55·8	89·8	44·2	197	252
Geraldton ...	30·115	30·113	30·400	29·790	70·0	54·0	62·0	79·0	40·0	74·1	55·2	89·0	39·3	188	346
Inland:															
Hall's Creek ...	30·034	30·072	...	...	79·8	56·7	68·2	94·6	50·0	84·1	55·6	98·0	36·4	201	2711
Marble Bar* ...	...	...	...	...	87·5	62·2	74·8	95·0	44·0	88·9	59·9	95·5	48·5	34	561
Nullagine ...	30·040	30·068	30·296	29·834	80·8	56·8	68·8	91·5	44·0	81·6	52·4	91·0	38·0	18	410
Peak Hill ...	30·100	30·108	30·440	29·890	71·0	52·0	61·5	87·0	39·0	73·1	52·5	86·2	40·0	78	156
Wiluna ...	30·110	...	30·471	29·874	70·8	47·4	59·1	86·7	31·9	...	...	...	...	242	318
Cue	30·125	30·130	30·470	29·880	71·8	49·1	60·4	88·0	36·0	74·4	51·2	91·0	35·9	136	163
Yalgoo ...	...	30·126	30·447	29·860	70·1	46·9	58·5	85·0	36·0	72·9	49·8	92·2	38·0	93	203
Lawlers ...	30·156	30·150	30·516	29·813	69·7	47·7	58·7	86·4	33·0	70·3	49·4	86·0	34·0	105	279
Laverton* ...	30·131	30·178	30·532	29·918	68·9	47·1	58·0	87·8	30·5	71·6	49·3	86·0	31·0	171	368
Menzies ...	30·146	30·174	30·574	29·834	68·4	46·1	57·2	85·5	33·5	68·6	48·4	89·0	32·1	82	152
Kanowna ...	...	...	...	...	69·1	47·3	58·2	84·5	32·0	...	...	...	...	108	146
Kalgoorlie ...	30·149	30·180	30·569	29·781	67·4	47·4	57·4	84·0	34·9	67·8	48·5	88·1	34·5	152	234
Coolgardie ...	30·144	30·182	30·567	29·774	66·9	48·1	57·5	83·0	33·8	67·7	47·5	88·4	35·1	134	280
Southern Cross	30·160	30·152	30·553	29·750	66·9	43·0	55·0	82·8	30·0	68·8	45·0	90·0	30·8	229	410
Walebing ...	...	...	...	...	65·4	43·0	54·2	76·4	31·0	...	...	...	...	175	439
Northam ...	...	...	...	...	65·8	45·2	55·5	75·0	34·0	...	...	...	...	194	563
York	30·165	30·156	30·550	29·760	65·8	45·3	55·6	75·2	33·0	69·5	45·3	85·0	32·0	195	511
Guildford* ...	...	...	...	...	67·3	47·0	57·2	74·0	36·0	70·4	50·4	85·0	33·5	421	877

* Average for three years only.

The Climate of Western Australia during May, 1904—*continued.*

Locality.	Barometer (corrected and reduced to sea-level). Mean of 9 a.m. and 3 p.m.	Barometer: Average for previous years.	Barometer: Highest for Month.	Barometer: Lowest for Month.	Shade Temperatures, May, 1904: Mean Max.	May, 1904: Mean Min.	May, 1904: Mean of Month.	May, 1904: Highest Max.	May, 1904: Lowest Min.	Average for previous Years: Mean Max.	Average for previous Years: Mean Min.	Average for previous Years: Highest ever recorded.	Average for previous Years: Lowest ever recorded.	Rainfall: Points (100 to inch) in Month.	Rainfall: Total Points since Jan. 1
South-West and South Coast:															
Perth Gardens ...	30·161	30·119	30·518	29·627	66·1	50·0	58·0	73·0	42·5	69·9	50·5	92·0	35·0	334	756
Perth Observatory	30·169	30·144	30·543	29·618	65·8	50·5	58·2	72·5	42·3	69·0	52·3	82·4	39·9	319	771
Fremantle ...	30·166	30·130	30·508	29·712	65·6	53·0	59·3	71·0	45·0	68·8	54·9	80·4	43·0	431	696
Rottnest ...	30·156	30·121	30·492	29·708	65·3	55·3	60·3	71·0	47·6	68·0	57·3	78·0	45·0	370	542
Mandurah * ...	...	...	...	...	65·6	...	...	71·3	38·1	69·2	49·6	80·7	36·5	482	856
Wandering ...	...	...	...	...	66·6	45·6	56·1	70·0	31·0	...	...	...	...	366	609
Narrogin... ...	...	...	...	...	59·9	45·4	52·6	66·4	36·0	...	...	...	...	199	454
Collie *	...	...	...	...	63·4	41·4	52·4	69·7	28·8	66·0	40·8	77·4	29·0	345	892
Donnybrook ...	...	...	...	...	64·0	45·5	54·8	69·9	34·9	...	...	...	...	365	1100
Bunbury ...	30·080	30·142	30·560	29·700	66·3	49·7	58·0	72·0	41·0	68·5	50·4	82·0	36·0	427	1011
Busselton * ...	...	...	...	...	65·7	47·0	56·4	72·0	37·0	67·0	48·3	77·7	35·0	425	905
Cape Naturaliste	...	...	...	...	63·9	52·8	58·4	75·0	45·2	...	...	...	...	355	881
Bridgetown * ...	...	...	...	...	63·9	41·2	52·6	70·9	27·0	66·6	41·5	77·9	30·9	336	856
Karridale ...	30·070	30·130	30·450	29·510	65·9	48·7	57·3	71·5	34·0	67·8	48·4	81·1	35·5	546	1095
Cape Leeuwin ...	30·095	...	30·510	29·390	65·0	55·4	60·2	70·2	46·0	...	...	...	...	580	1067
Katanning ...	30·140	30·150	30·580	29·580	62·0	45·0	53·5	68·0	33·0	65·2	44·1	79·0	30·5	184	540
Albany	30·126	30·128	30·558	29·455	64·4	47·5	56·0	73·8	35·8	65·6	48·7	80·0	35·1	704	1349
Breaksea... ...	30·112	...	30·574	29·371	62·0	53·6	57·8	73·0	45·2	...	...	...	...	668	1168
Esperance ...	30·205	30·170	30·640	29·670	67·0	48·0	57·5	78·0	35·0	68·0	49·9	86·0	35·0	390	753
Balladonia ...	30·181	...	30·576	29·676	68·0	45·4	56·7	87·6	35·9	...	...	...	...	211	326
Eyre	30·118	30·188	30·444	29·710	69·0	48·9	58·9	92·2	37·5	68·3	48·4	91·2	34·0	249	585
INTER-STATE.															
Perth	30·169	30·144	30·543	29·618	65·8	50·5	58·2	72·5	42·3	69·0	52·3	82·4	39·9	319	771
Adelaide	30·184	...	30·492	29·888	67·3	49·9	58·6	81·7	36·9	...	...	...	...	300	821
Melbourne	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sydney	30·200	...	30·550	29·830	65·0	54·0	60·0	76·0	4·40	...	...	...	...	520	2868
Cocos Island ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

* Average for three years only.

The Observatory, Perth, May, 1904.

W. E. COOKE, Government Astronomer.

RAINFALL for April, 1904 (completed as far as possible), and for May, 1904 (principally from Telegraphic Reports).

Stations.	April. No. of points. 100 = 1in.	April. No. of wet days.	May. No. of points. 100 = 1in.	May. No. of wet days.
East Kimberley:				
Wyndham ...	315	8	30	3
6-Mile	357	6	...	...
The Stud Station	...	...	...	...
Carlton	231	5	...	...
Denham	...	...	...	...
Rosewood Downs	...	...	...	...
Argyle Downs ...	166	10	...	...
Turkey Creek ...	240	6	104	...
Hall's Creek ...	261	6	201	4
Flora Valley ...	...	...	...	...
Ruby Plains ...	432	5	...	...
Denison Downs...	330	3	...	...
West Kimberley:				
Obagama ...	...	...	...	...
Beagle Bay ...	...	...	...	...
Derby	517	6	7	1
Yeeda	...	...	...	...
Liveringa ...	902	2	...	...
Leopold Downs...	...	...	...	...
Fitzroy Crossing	507	5	75	3
Fitzroy (C. Blythe)	520	3	...	...
Quanbun ...	840	3	...	...
Broome	610	5	108	2
Roebuck Downs	...	...	...	...
Thangoo	...	...	...	...
La Grange Bay...	275	6	32	2
North-West:				
Wallal	12	1	...	...
Condon	Nil	...	24	3
Pardoo	...	...	...	...
DeGrey River ...	Nil	...	...	...
Port Hedland ...	9	1	36	2
Boodarie ...	Nil	...	...	...
Warralong ...	42	1	...	...
Ettrick	26	1	...	...
Mulgie	12	1	...	...
Eel Creek ...	26	1	...	...
Station Peake ...	Nil	...	...	...
Coongon	Nil	...	...	...
Warrawagine ...	15	1	...	...
Bamboo Creek ...	52	2	37	2
Marble Bar ...	19	1	34	5
Warrawoona ...	69	3	35	3
Corunna Downs...	28	2	...	...
Nullagine ...	36	2	18	1
North-West—*cont.*				
Mount Edgar ...	...	...	...	...
Kerdiadary ...	...	...	...	...
Roy Hill	...	...	...	...
Middle Creek ...	69	2	...	...
Mosquito Creek	...	...	...	...
Mulga Downs ...	...	...	...	...
Woodstock ...	...	...	...	...
Mt. Florence ...	Nil	...	...	...
Tambrey ...	...	...	...	...
Millstream ...	Nil	...	...	...
Mallina	...	...	...	...
Whim Creek ...	Nil	...	38	1
Cooyapooya ...	Nil	...	...	...
Woodbrooke ...	...	...	...	...
Croydon	...	...	...	...
Roebourne ...	Nil	...	94	4
Cossack	Nil	...	106	5
Fortescue ...	50	1	57	5
Mardie	Nil	...	...	...
Yarraloola ...	...	...	...	...
Chinginarra ...	Nil	...	...	...
Onslow	Nil	...	306	6
Peedamullah ...	...	...	...	...
Red Hill	23	2	...	...
Mt. Mortimer ...	49	2	...	...
Peake Station ...	63	4	...	...
Wogoola ...	...	...	...	...
Nanutarra ...	Nil	...	...	...
Point Cloates ...	Nil	...	...	...
Gascoyne:				
Winning Pool ...	Nil	...	108	5
Coordalia ...	Nil	...	...	...
Gifford Creek ...	Nil	...	...	...
Bangemall ...	Nil	...	...	...
Minnie Creek ...	3	1	...	...
Yanyeareddy ...	Nil	...	...	...
Williambury ...	Nil	...	...	...
Bernier Island ...	10	1	...	...
Boolathana ...	10	1	...	...
Carnarvon ...	15	1	43	5
Brick House ...	2	1	...	...
Doorawarrah ...	2	1	...	...
Bintholya ...	Nil	...	...	...
Mungarra ...	Nil	...	...	...
Clifton Downs ...	Nil	...	...	...
Dairy Creek ...	Nil	...	...	...

RAINFALL—*continued.*

Stations.	April. No. of points. 100 = 1in.	April. No. of wet days.	May. No. of points. 100 = 1in.	May. No. of wet days.
Gascoyne—*contd.*				
Upper Clifton Downs	8	1	...	...
Dirk Hartog Island	38	1	...	...
Sharks Bay ...	10	1	163	4
Meedo	7	1	...	...
Tamala	14	1	...	...
Wooramel ...	12	1	213	5
Hamelin Pool ...	19	1	197	4
Byro	7	1	112	4
Yarra Yarra ...	Nil	...	141	2
Berringarra ...	2	1	146	6
Mt. Gould ...	5	1	...	...
Moorarie ...	Nil	...	...	...
Wandary... ...	Nil	...	180	3
Peak Hill ...	21	1	78	5
Horseshoe ...	28	1	172	5
Mt. Fraser ...	Nil	...	...	...
Abbotts	10	1	168	5
Belele	11	1	...	...
Mileura	Nil	...	136	2
Milly Milly ...	Nil	...	102	5
Manfred ...	1	1	140	4
New Forest ...	17	1	...	...
Twin Peaks ...	4	1	104	3
Billabalong ...	7	1	..	...
Wooleane ...	7	1	216	4
Murgoo	Nil	...	150	3
Yallalonga ...	9	1	...	...
Meka	Nil	...	188	5
Mt. Wittenoom ...	Nil	...	170	5
Nannine	4	1	100	4
Star of the East...	Nil	...	108	4
Annean	5	2	...	...
Coodardy ...	25	1	...	...
Cue	3	2	136	5
Day Dawn ...	7	2	144	5
Lake Austin ...	Nil	...	155	...
Lennonville ...	14	2	292	7
Mt. Magnet ...	5	1	273	6
Challa	32	4	...	...
Youeragabbie ...	40	1	...	...
Murrum	...	...	170	3
Burnerbinmah ...	3	1	...	...
Barnong	25	1	...	...
Mellinbye ...	42	1	69	6
Yalgoo	5	1	93	4
Wagga Wagga ...	Nil	...	...	...
Gabyon	17	1	...	...

Stations.	April. No. of points. 100 = 1in.	April. No. of wet days.	May. No. of points. 100 = 1in.	May. No. of wet days.
South-West Division (Northern Part):				
Murchison House	20	1	...	...
Mount View ...	15	1	...	...
Mumby	65	1	87	5
Yuin	4	1	90	4
Northampton ...	57	1	139	5
Oakabella ...	33	1	...	...
Narra Tarra ...	...	...	...	...
Myaree	51	1	..	...
Mullewa... ...	43	1	75	4
Kockatea ...	48	1	48	3
Geraldton ...	63	2	188	8
Greenough ...	10	1	55	2
Bookara	...	...	120	5
Dongara ...	38	1	74	7
Dongara (Pearse)	38	1	64	7
Strawberry ...	...	...	78	4
Nangetty ...	42	1	...	...
Mingenew ...	61	1	59	8
Urella	44	1	55	3
Yandenooka ...	82	1	111	5
Rothesay ...	45	3	...	...
Field's Find ...	11	2	...	...
Carnamah ...	34	1	134	7
Watheroo ...	50	1	149	9
Dandaragan ...	86	2	199	9
Moora	86	2	141	8
Yatheroo ...	98	1	274	11
Walebing ...	60	1	175	10
New Norcia ...	79	3	149	8
South-Western Division, Central (Coastal):				
Gingin	121	2	347	11
Belvoir	180	4	315	10
Mundaring ...	196	5	371	17
Wandu	...	...	330	16
Guildford ...	243	4	421	16
Kalbyamba ...	248	4	...	...
Canning W't'r'w'ks	183	3	319	8
Perth Gardens ...	291	6	334	16
Perth Observatory	313	5	319	16
Subiaco	205	5	396	15
Fremantle ...	74	5	431	18
Rottnest... ...	62	5	370	21

RAINFALL—*continued.*

Stations.	April. No. of points. 100 = 1in.	April. No. of wet days.	May. No. of points. 100 = 1in.	May. No. of wet days.
SOUTH-WESTERN—*continued.*				
Armadale ...	178	3	389	15
Rockingham ...	154	6	524	18
Jarrahdale ...	239	4	744	15
Mandurah ...	142	5	482	17
Pinjarra	198	4	501	15
Yarloop	167	5	428	19
Harvey	229	6	...	...
Upper Murray ...	140	3	627	16
SOUTH-WEST, CENTRAL PART (INLAND):				
Hatherley ...	35	1	...	...
Dowerin ...	36	1	...	...
Momberkine ...	115	1	150	10
Monglin ...	71	2	240	8
Newcastle ...	114	1	265	11
Eumalga ...	148	4	277	12
Northam ...	90	1	194	11
Grass Valley ...	81	1	...	...
Meckering ...	68	2	159	9
Cunderdin ...	78	2	240	9
Codg-Codgin ...	37	2	...	...
Yarragin ...	64	4	...	...
Doongin... ...	59	2	...	...
Cuttening ...	49	2	205	11
Whitehaven ...	59	2	316	8
Sunset Hills ...	96	2	204	14
Cobham	120	3	252	17
Yenelin	49	2	...	...
York	119	2	195	22
Dalbridge ...	101	2	189	12
Beverley ...	100	1	242	11
Bally Bally ...	92	4	228	15
Barrington ...	87	1	229	13
Stock Hill ...	85	1	187	10
Sunning Hill ...	...	...	242	11
Wandering ...	91	1	366	13
Glen Ern ...	110	5	257	17
Pingelly ...	90	1	139	8
Marradong ...	100	2	389	12
Bannister ...	91	3	364	15
Narrogin ...	89	4	154	17
Narrogin Experimental Farm	94	5	199	18
Wickepin ...	51	2	173	12
Gillimaning ...	50	2	...	...
Bullock Hills ...	61	2	...	...

Stations.	April. No. of points. 100 = 1in.	April. No. of wet days.	May. No. of points. 100 = 1in.	May. No. of wet days.
SOUTH-WEST DIVISION (SOUTHERN PART):				
Bunbury ...	246	6	427	18
Collie	192	7	345	19
Glen Mervyn ...	259	7	...	...
Donnybrook ...	216	5	365	15
Boyanup ...	265	9	475	15
Ferndale ...	203	8	423	17
Busselton ...	141	5	425	22
Quindalup ...	161	5	...	...
Cape Naturaliste	191	5	...	...
Lower Blackwood	355	8	558	16
Karridale ...	240	9	546	21
Cape Leeuwin ...	173	11	580	22
Biddellia ...	276	7	422	17
The Warren ...	338	9	605	19
Lake Muir ...	172	10	327	11
The Peninsula ...	201	10	282	19
Mordalup ...	131	8	289	15
Deeside	104	5	407	17
Riverside ...	117	7	...	...
Balbarup ...	189	6	331	12
Wilgarup ...	218	7	332	20
Mandalup ...	...	...	...	...
Bridgetown ...	186	6	336	19
Westbourne ...	135	6	350	21
Hillton	101	3	238	5
Greenbushes ...	299	5	477	14
Greenfields ...	184	5	294	14
Glenorchy ...	118	6	309	14
Williams ...	56	2	233	18
Arthur	62	2	190	9
Darkan	64	3	258	9
Wagin	102	5	227	13
Glencove ...	83	5	183	16
Dyliabing ...	75	5	218	13
Katanning ...	114	6	184	...
Kojonup ...	148	8	278	17
Broomehill ...	73	5	157	11
Sunnyside ...	76	7	145	15
Woodyarrup ...	81	4	...	...
Minelup ...	62	4	200	14
Cranbrook ...	82	5	125	11
Toolbrunup ...	38	4	210	14
Tambellup ...	106	8	165	15
Blackwattle ...	147	8	229	11
Woogenellup ...	95	6	141	14
Mt. Barker ...	125	7	448	18
Kendenup ...	135	8	...	...

RAINFALL—*continued.*

Stations.	April. No. of points. 100 = 1in.	April. No. of wet days.	May. No. of points. 100 = 1in.	May. No. of wet days.
South-West—*contd.*				
St. Werburgh's...	151	7	334	18
Forest Hill ...	126	9	443	22
Denmark ...	170	4	502	15
Grassmere ...	201	9	614	19
Albany	224	14	704	25
King River ...	165	6	570	16
Point King ...	181	9	575	22
Breaksea ...	156	18	668	28
Cape Riche ...	102	4	...	...
Cherilullup ...	80	6	...	...
Pallingup ...	73	3	141	14
Bremer Bay ...	78	5	490	15
Eastern Division:				
Dural	31	1	...	...
Wiluna	55	1	242	9
Gum Creek ...	43	2	...	...
Mt. Sir Samuel ...	22	[illegible]	120	3
Lawlers	85	2	105	8
Leinster G.M. ...	107	2	158	5
Darda	41	2	231	5
Lake Darlôt ...	31	1	104	4
Mt. Leonora ...	11	2	109	6
Mt. Malcolm ...	2	1	112	6
Mt. Morgans ...	102	1	155	5
Laverton ...	57	3	171	6
Murrin Murrin...	21	1	175	6
Yundamindera ...	26	1	239	6
Tampa	18	2	...	...
Kookynie ...	3	1	83	4
Niagara	Nil	...	95	5
Yerilla	Nil	...	93	5
Edjudina ...	53	3	111	7
Menzies	22	3	82	5
Mulline	Nil	...	137	3
Waverley ...	12	1	117	5
Goongarrie ...	5	1	97	4
Mulwarrie ...	4	1	154	3
Bardoc	Nil	...	80	3
Broad Arrow ...	10	1	120	9
Kurnalpi ...	6	1	126	7
Bulong	25	1	195	7
Kanowna ...	12	1	108	9
Kalgoorlie ...	24	1	152	7
Coolgardie ...	65	2	134	8

Stations.	April. No. of points. 100 = 1in.	April. No. of wet days.	May. No. of points. 100 = 1in.	May. No. of wet days.
Eastern—*contd.*				
Burbanks ...	28	1	144	7
Woolubar ...	145	...	198	6
Widgiemooltha...	50	2	192	8
50-Mile Tank ...	142	3	...	...
Waterdale ...	63	2	217	9
Norseman ...	131	4	264	12
Lake View ...	90	5	339	10
Bulla Bulling ...	34	2	153	10
Boondi	57	3	224	9
Boorabbin ...	43	4	198	9
Koorarawalyee...	10	1	226	8
Karalee	39	2	142	5
Southern Cross...	2	1	229	8
Parker's Range...	39	5	200	13
Parker's Road ...	48	2	184	8
Mt. Jackson ...	11	1	233	6
Bodallin ...	13	1	179	10
Burracoppin ...	57	2	115	6
Kellerberrin ...	37	2	258	12
Merredin ...	40	1	78	3
Nangeenan ...	37	1	148	8
Mangowine ...	39	3	219	4
Eucla Division:				
Ravensthorpe ...	75	9	248	11
Coconarup ...	83	5	...	...
Hopetoun ...	99	7	333	10
Fanny's Cove ...	31	4	...	...
Park Farm ...	86	6	347	13
Esperance ...	119	9	390	14
Gibson's Soak ...	99	6	305	16
30-Mile Condenser	77	5	271	13
Swan Lagoon ...	31	3	258	11
Grass Patch ...	39	6	240	12
Myrup	151	9	151	9
Lynburn ...	169	5	263	14
Boyatup	203	7	...	...
Point Malcolm ...	...	...	340	17
Israelite Bay ...	198	9	373	13
Balbinia	132	4	277	8
Frazer Range ...	131	4	...	...
Balladonia ...	81	2	211	8
Southern Hills ...	275	3	...	...
Eyre	45	5	249	11
Eucla	137	10	349	8

The Observatory, Perth,
8th June, 1904.

W. E. COOKE,
Government Astronomer.

By Authority: WM. ALFRED WATSON, Government Printer, Perth.